U. S. Government

RESEARCH REPORTS

April 17, 1959
Vol. 31, No. 4

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U. S. DEPARTMENT OF COMMERCE

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OFFICE OF TECHNICAL SERVICES
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Naval Research Lab., Washington, D.C.
BIBLIOGRAPHY OF UNCLASSIFIED NRL FORMAL REPORTS NUMBERS 1000 TO 5000. Dec 58, 13p.
NRL Rept. 5000B.
Order from OTS $2.75 PB 151 428

Section 1 is a listing, by number, of NRL formal reports, giving the classification, title, authors, and date of all reports from 1000 to 5000, except those reports classified AEC Restricted Data and those Secret reports with Secret titles. Section 2 is an alphabetical index of authors, giving the numbers of reports only. Section 3 is a listing of reports issued in series.

AGRICULTURE

American Inst. of Crop Ecology, Washington, D.C.
CLIMATE, AGRICULTURE AND AGRICULTURAL ZONES OF BURMA, by M.Y. Nuttonson. Supplement to Background Study of Burma: Review of its Physical Environment, Flora and Agriculture, 1955, on Contract DA 18-064-404-cml-68. Feb 57, 149p.
Order from LC mi $7.20, ph $22.80 PB 135 975

National Research Council, Washington, D.C.
COMPOSITION OF CERAL GRAINS AND FORAGES, by Donald E. Miller. June 58, 682p. 865 refs.
Order from NRC* Free NRC-585

Report of the Committee on Feed Composition of the Agricultural Board
* National Research Council
2101 Constitution Ave., N.W., Washington, D.C.

Ohio U., Athens.
SYNTHESIS OF A SERIES OF PHOSPHONIC AND PHOSPHINIC ACIDS AND RELATED COMPOUNDS, by Robert K. Ingham and Joseph M. Denham.
Final rept. Feb 57, 66p. 31 refs.
Order from LC mi $3.90, ph $10.80
PB 135 242

The purpose of this work was to synthesize and obtain chemical properties of certain organophosphorus compounds and their derivatives for possible use as plant growth substances. During this period, a number of phosphonic and phosphinic acids and their derivatives have been prepared and submitted for evaluation.

ASTRONOMY

Research Service Labs., U. of Colorado, Boulder.
DEVELOPMENT OF A HIGH-FREQUENCY ANTENNA FOR RADIO ASTRONOMY, by James W. Warwick and Palmer W. Carlin. Final rept. on Contract AF 19(604)1503. 15 May 58, 21p.
Order from LC mi $2.70, ph $4.80 PB 135 969

This report summarizes the problems of antenna design and construction met under a program for observation of discrete radio noise sources (radio stars) in the frequency range 15 to 40 Mc. /s. The structures finally built are trihedral corner reflectors, 3/4 wavelength long, and 5/8 wavelength high, with an aperture angle of 120°, and a double-monopole feed.

Astrophysics

American Meteorological Society, Boston, Mass.
STUDY OF THE DEVELOPMENT OF CHROMOSPHERIC FLARES ON THE SUN (Issledovanie Razvitiya Khromosfernykh Vspyshek na Solntse) by A.B. Severnyi and E.F. Shaposhnikova, tr. by David Kraus on Contract AF 19(604)1936. May 56 [59]p. 18 refs.
Order from LC mi $3.60, ph $9.30 PB 138 031

Trans. of [Akademiya Nauk SSSR] Krymskaya Astrofizicheskaya Observatoriya. Izvestiya, 1954, v. 12, p. 3-32.

An instrument and a method are described for the continuous cinematography of the development of active formations on the sun. Eighteen of the 55 flares observed in 1952 were subjected to a detailed analysis in order to study the motions, intensities, and peculiarities of their development. The development of some flares is accompanied by motions in the form of jets, ejections, and elongations (flares of type I). The character of these motions is fully analogous to those in the "electromagnetic" prominences that appear near the sunspots. The development of the remaining (most) flares is accompanied, fundamentally, by a more or less uniform expansion of contraction of the flare (flares of type II). Flares expand during flareup and contract during dissolution, whereby the intensity of the flare at maximum is the greater, the greater the velocity of expansion of the flare. No correspondence was found between the intensity of the flare at maximum and its maximum area; this indicates that a re-examination of the usual evaluation of a flare is in order, that is, the evaluation of the basis of importance of the area of the flare maximum. A relationship was discovered between the area of the flare and its lifetime. This relationship is analogous to the one obtained for prominences and gives an indication of the processes causing intensive dissipation of energy.

Armour Research Foundation, Chicago, Ill.
INVESTIGATION OF SOLAR GAMMA RAY, by G. M. Burgwald and C.A. Stone. Final rept. on Contract AF 19(604)1499. 23 June 58, 46p. 20 refs. AFCRC TR-58-252; AD-152 630.
Order from LC mi $3.30, ph $7.80 PB 136 056

In order to determine whether proton induced nuclear reactions take place on the surface of the sun, an experiment has been performed to establish the existence of a capture gamma ray produced in one of the interactions.

Georgetown Coll. Observatory, Washington, D.C.
KNOWN PHYSICAL CHARACTERISTICS OF THE MOON AND THE PLANETS, by Carl C. Keiss and K. Lassovzsky. Rept. on Contract AF 18(600)1770. July 58, 42p. 170 refs. ARDC TR-58-41; AD-115 617.
Order from LC mi $3.30, ph $7.80 PB 135 882

The physical characteristics of the Moon, Mercury, Venus and Mars are described in detail. The known dimensions, masses and densities are listed. The presence and composition of an atmosphere on each of these bodies is discussed and the planetary surfaces are described in terms of the available observational evidence. Details of significant scientific investigations are included throughout and show the development of modern ideas from early theories. The Major Planets, Jupiter, Saturn, Uranus and Neptune are described in a brief and general way and their important characteristics are listed. A short chapter describes the numerous lesser bodies such as comets and asteroids and the interplanetary material which ranges in size from planetoids to gas molecules. This report summarizes the progress made in planetary studies through early 1958. A list of the most significant literature references is included at the end of each chapter.

Stanford Research Inst., Menlo Park, Calif.
PREDICTED CHARACTERISTICS OF METEOR REFLECTIONS AT RADIO FREQUENCIES ABOVE 100Mc, by V.R. Eshleman, L.A. Manning, and A.M. Peterson. Technical rept. no. 1 on Contract AF 30(602)1462. Feb 57, 58p. 41 refs. AD-114 367.
Order from LC mi $3.60, ph $9.30 PB 135 357

In this report predictions are made of the characteristics of the meteor echoes which can be detected by high-sensitivity monostatic or bistatic radars operating at wavelengths between about 30 and 0.3 meters. Past experimental and theoretical investigations of meteor echoes in the 30 to 3 meter wavelength range are reviewed, and recent theoretical investigations of echo characteristics at wavelengths shorter than 3 meters are presented. In order to predict the characteristics of meteor echoes obtained at the shorter wavelengths, the following are analyzed: the numbers, intensities, durations, polarizations, and Doppler frequencies of the echoes; and the variation of these factors with time of day and season, and with the system parameters, including wavelength, output power, received sensitivity, distance between transmitter and receiver, and the gain, elevation, and azimuth of the antenna beam.

BEHAVIORAL SCIENCES

Human Engineering

American Inst. for Research [Pittsburgh, Pa.]
HUMAN FACTORS RECOMMENDATIONS FOR THE DESIGN OF COCKPIT PROCEDURES TRAINERS, by Benjamin Schohan. Rept. on Human Factors in the Design of Operator Trainers, Contract AF 33 (616)2080. Sep 58, 59p. 21 refs. WADC Technical rept. 56-527; AD-110 654.
Order from OTS $1.50 PB 151 470

The cockpit procedures trainer (CPT) appears to have promising potential as a training aid to teach pilots knowledge about aircraft systems, nomenclature and location of cockpit controls and displays, and procedures required to operate aircraft safely. This report is intended to aid design engineers by presenting first a discussion of the cockpit procedures trainer's role in training, and, second, a set of human engineering recommendations pertinent to the design of such trainers for fighter-type jet aircraft.

Army Medical Research Lab., Fort Knox, Ky.
JUDGMENT OF ANGULAR POSITIONS IN THE HORIZONTAL PLANE ON THE BASIS OF KINESTHETIC CUES, by L.S. Caldwell and M.J. Herbert. 17 Jan 56, 26p. 2 refs. Rept. no. 216.
Order from LC mi $2.70, ph $4.80 PB 136 862

It was found that adjustive movements of the arm in the horizontal plane are most accurate near the 0^{o} and 90^{o} positions. The 0^{o} position is directly in front of the right shoulder and the 90^{o} position is 90 clockwise from this point. Adjustive movements of the arm toward the 90 end of the scale are more accurate than those toward 0^{o}.

Aviation Psychology Lab., Ohio State U. Research Foundation, Columbus.
THE EFFECT OF ENROUTE FLOW CONTROL ON TERMINAL SYSTEM PERFORMANCE. A STUDY IN HUMAN ENGINEERING ASPECTS OF RADAR AIR TRAFFIC CONTROL, by J.S. Kidd, Maynard W. Shelly and others. Rept. on Contract AF 33(616) 3612; Continuation of Contract AF 33(616)43. Apr 58 [38]p. 15 refs. WADC Technical rept. 57-663; AD-142 096.
Order from OTS $1.00 PB 151 467

The purpose of the experiment was to determine the effect of regularization of approach traffic in time, place, and sequence upon the safety and efficiency of a terminal system. Enroute flow-control facilities were simulated by preprogramming arrivals at the terminal boundary. The terminal system was manned by a two-man pattern-feeder control team. Six pairs of experienced USAF controllers participated. The control zone included two landing fields and each controller handled aircraft destined for each of these fields. Data were recorded for a total of 2880 movements of mixed types. The results and conclusions of the experiment are as follows: (1) Traffic input regularization in time, place, and sequence relative to the controller who accepted the traffic had an insignificant effect on terminal system performance. (2) Human controllers can provide the flexibility necessary to accommodate widely varying input entropy.

Aviation Psychology Lab., Ohio State U. Research Foundation, Columbus.
THE USE OF COLOR IN CODING DISPLAYS, by Donald W. Conover and Conrad L. Kraft. Rept. on Contract AF 33(616)3612; Continuation of Contract AF 33(616)43. Oct 58, 21p. 46 refs. WADC Technical rept. 55-471; AD-204 214.
Order from OTS $0.75 PB 151 463

The objectives of this study were to (a) determine the maximum number of absolutely identifiable hues, (b) construct an "equal-discriminability" scale of hues, and (c) to validate the scale on an independent population sample. Surface colors from the Munsell fifty-hue series of colored paper provided the stimulus material. Results indicate that for practical coding purposes a maximum of five to eight colors can be used, with the exact number depending on the viewing condition and the proportion of the population that must read the code without error. Advantages and disadvantages of color in coding are discussed; current engineering practice is reviewed. A color plate gives examples of 8, 7, 6, and 5-category codes. Specifications for these codes are given in the text.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE DESIGN OF CHARACTERS FOR THE CHARACTRON, by W.P. Harris, B.F. Green and others. Rept. on Contract AF 19(122)458. 22 Mar 56, 27p. 5 refs. Technical rept. no. 117.
Order from LC mi $2.70, ph $4.80 PB 130 884

Several studies are reported concerning the design of characters that would have maximum legibility on the Charactron display. An experiment was made to evaluate the legibility of numerals designed by Mackworth. The results were used as a basis for redesigning some of the numerals. The legibility of special symbols was studied in a second experiment. A complete set of 63 characters was designed for the Charactron, and was evaluated in an extensive experiment. Legibility was generally good, but some changes were suggedted. Evaluation of these changes led to recommendations for an improved set of characters. An attempt was made to interpret confusions among characters to provide tentative hypotheses for a theory of legibility.

Miami U., Oxford, Ohio.
ILLUMINATION AND TILT AS FACTORS IN THE LEGIBILITY OF REFLEX-REFLECTIVE NUMERALS, by Clarke W. Crannell and Anthony Debons (Aero Medical Lab., Wright Air Development Center). Rept. on Visual Presentation of Information, Contract AF 33(616)2844. Sep 58, 25p. 2 refs. WADC Technical rept. 58-47; AD-142 327.
Order from OTS $0.75 PB 151 480

AND 10400 digits made of reflex-reflective material and placed on a black background were found to be superior in identifiability to black digits on white or aluminum backgrounds at distances greater than 400 feet and also at lesser distances when the digits are titled from the vertical axis. When the angle of observation is perpendicular to neither the vertical nor horizontal axis, legibility of digits of all types is reduced. At 500 feet, increases in illumination resulted in negligible improvement in legibility of the reflex-reflective digits.

Navy Electronics Lab., San Diego, Calif.
STUDY OF SEATING AS RELATED TO ELECTRONIC-EQUIPMENT OPERATORS, by W.E. Woodson. Rept. for period ending Sep 53. 9 Apr 54, 21p. 32 refs. Rept. no. 436.
Order from LC mi $2.70, ph $4.80 PB 136 708

A comprehensive survey of past and present chair design was made to establish functional characteristics of good seating. On the basis of these studies, an experimental chair was designed and studied both in the laboratory and at sea. The work to date has led to the following conclusions: (1) Present chair designs are not adequate for all sonar, radar, and communications operators' positions. A single universal chair does not appear to be feasible for all types of installations. (2) Certain features of chair design (such as seat cushion, arm rests, and back rests) should be standarized, in order to permit mounting on interchangeable mounts according to console and space requirements. (3) Special design features for maintaining body stability should be incorporated in all chairs of this type which are to be used aboard ships of destroyer size or smaller.

Personnel and Training

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
PHYSICAL PROFICIENCY AS A PREDICTOR OF LEADERSHIP, by John D. Krumboltz. May 57, 26p. 17 refs. AFPTRC TN-57-60; AD-126 391.
Order from LC mi $2.70, ph $.80 PB 137 118

Three populations were sampled to obtain cases for this study: Officer Candidate School (OCS) cadets, aviation cadets in preflight training, and preflight student officers (AFROTC graduates), who subsequently entered either pilot or observer training. Seven tests of physical characteristics and proficiency were administered to these men at the beginning of their training program at Lackland Air Force Base: Height; Weight; Medicine Ball Throw; Pull-ups; Hurdle Run; Hop, Step, and Jump; and 250-Yard Shuttle Run. Test-retest reliability coefficients based on 65 OCS cadets were obtained after a one-week interval. Leadership peer ratings were used as the criterion of leadership. Such ratings were collected routinely on aviation cadets and OCS cadets by training personnel. Special ratings were obtained on the student officers after they had left Lackland Air Force Base and had entered pilot or observer training. Analysis of the data was performed using two methods: (1) Multiple regression analysis was used to optimally weight each predictor, and multiple correlations with the criterion were obtained for each sample. (2) The correlation with the criterion of a composite equally weighted with five physical-proficiency tests (omitting height and weight) was computed for each sample.

Air Force Personnel and Training Research Center, Lackland AFB. Tex.
PREDICTION OF CREATIVITY AMONG AIR FORCE CIVILIAN EMPLOYEES, by M.H. Chorness and D.N. Nottelmann. Mar 57, 30p. 30 refs. AFPTRC TN-57-36; AD-126 366.
Order from LC mi $2.70, ph $4.80 PB 137 119

Contents:
Introduction
- Cognitive determinants of creativity
- Personality correlates of creativity
- Social determinants of creativity
- The trainability of creativity
- The criterion problem in creativity

Description of Air Force incentive awards program
Description of suggestions receiving awards
Statement of the problem
Method
- Research design and description of variables
- The personal data questionnaire
- Field procedure

Analysis and description of results
- Summary of matching data
- Comparison of award and control groups on creativity tests

Analysis of the personal data questionnaire

American Inst. for Research, Pittsburgh, Pa.
RESEARCH ON THE FEASIBILITY OF SELECTION OF PERSONNEL FOR DUTY AT ISOLATED STATIONS, by Leo R. Eilbert, Robert Glaser and Randall M. Hanes. Rept. on Contract AF 41(657) 74. July 57, 62p. 32 refs. AFPTRC TR-57-4; AD-134 241.
Order from LC mi $3.90, $10.80 PB 136 223

The objectives were to observe conditions at isolated Arctic stations and define the adjustment characteristics of the problems posed by the situation. To investigate possibilities for establishing feasible criteria of adjustment to these conditions. To investigate and identify promising leads for variables predictive of adjustment. To provide operational and development recommendations to be considered in future work.

Army Medical Research Laboratory, Fort Knox, Ky.
A PROGRAM FOR THE IMPROVEMENT OF THE NIGHT-SEEING-ABILITY OF GROUND TROOPS, by Lester B. Roberts and Wendell E. Mann. Rept. on Night Vision from Tanks, Proj. no. 7-5. 31 May 44, 5p.
Order from LC mi $1.80, ph $1.80 PB 135 308

Improved night-seeing ability can be done by selection, education and training and by supplying visual aids.

Human Factors Research Inc., Los Angeles, Calif.
PREDICTABILITY OF RATINGS AS A FUNCTION OF INTER-RATER AGREEMENT, by Donald N.

Buckner. Technical rept. 8 on Research on the Development of Performance Criteria, Contract Nonr-1241(00). June 57, 23p. AD-136 922.
Order from LC mi $2.70, ph $4.80 PB 136 041

The hypothesis tested was that high agreement among the ratings assigned the same men by different raters does not necessarily imply predictable ratings. Ratings by three superior officers (Officers and Chief Petty Officers) of 100 submarines serving aboard 21 different submarines were divided into four samples so as to achieve four levels of inter-rater agreement (.00, .69, .84 and .94). Correlations were then computed within each sample between three predictor variables (Submarine School Class standing and the Navy General Classification and Mechanical Aptitude Tests) and the mean of the three ratings assigned to each ratee. The hypothesis was supported by the results. It was concluded that high inter-rater agreement does not necessarily imply predictability and may indicate a lack of it. Low agreement, on the other hand, may in some cases indicate predictability and possibly validity.

International Research Associates, Inc., New York.
EXPERIMENTS ON THE USE OF THE BASIC LESSON PLANS FOR THE TEACHING OF MAP READING IN THE MARINE CORPS RESERVE (GROUND). Technical rept. no. 4 on Training Problems in the Marine Corps Reserve, Contract Nonr-1654(00). Jan 57, 118p.
Order from LC mi $6.00, ph $18.30 PB 136 185

These experiments were designed to test methods for increasing the efficiency of training in the Marine Corps Reserve (Ground) and provide a model which the Reserve can use as a guide for the development of systems of evaluation of other areas of training. These following objectives were accomplished: The development of a standard procedure for teaching three sub-areas of the General Military Subject, Use of the Compass and Basic Map Reading. This procedure is called the Basic Lesson Plan. The setting up of variations which stress or eliminate certain elements of the Basic Lesson Plan. The testing by means of controlled experiment of the relative effectiveness of the Basic Lesson Plan and its variations.

James Forrestal Research Center, Princeton, N.J.
HUMAN PILOT DYNAMIC RESPONSE IN FLIGHT AND SIMULATOR, by Edward Seckel, Ian A. M. Hall and others. Rept. on Contract AF 33(616)-2506. Aug 58, 66p. 8 refs. WADC Technical rept. 57-520; AD-130 988.
Order from OTS $1.75 PB 151 465

Results of an effort to determine differences in pilot tracking behavior in flight and in a flight simulator are presented. The experiment was designed to estimate the quasi-linear describing functions and linear correlations of several pilots when engaged in lateral and longitudinal tracking tasks. Statistical analyses of describing function and linear correlation data revealed: (1) Individual phase angle, amplitude ratio, and linear correlation data were approximately normally distributed about their means; (2) Significant differences in the mean values of pilot's describing functions were noted for phase angle and amplitude ratio in longitudinal flight, and for phase angle in lateral flight; (3) Significant differences in linear correlations between flight and simulator were noted; (4) Significant differences were noted in the variances for lateral amplitude ratio and lateral and logitudinal phase, but not for longitudinal amplitude ratio or lateral and longitudinal linear correlations; (5) The results implied that the pilot's effective reaction time delay was longer in flight and that his gain was lower.

National Research Council, Washington, D.C.
FELLOWSHIP SELECTION RESEARCH, by Lindsey R. Harmon. Four-year progress rept. Jan 57, 41p.
Order from NRC* $1.00 NRC-564

Contents
Ch. one: Historical sketch
Ch. two: Evidence submitted in support of fellowship candidacy
Ch. three: Reliability of techniques and procedures
Ch. four: Research on selection instruments and panel operations
Ch. five: Follow-up validation of fellowship selection procedures
Ch. six: Potential new selection devices
Ch. seven: A summary and look to the future
Appendixes (Briefs of the following reports):
(1) An analysis of the evaluation panel suggestions on the 1953 NSF fellowship material
(2) A factorial study of the 1952 NSF confidential report ratings
(3) A factorial study of 28 predictor scores in the 1953 NSF fellowship program
(4) A description of two groups of scientists on a scientific adviser report form
(5) The significance of descriptive comments on confidential reports
(6) Selection of post-doctoral fellows by an interdisciplinary board
(7) Ability patterns in seven science fields
(8) Are confidential reports affected by candidates' length of residence in a department?

Personnel Lab., Lackland AFB, Tex.
RELATIONSHIPS BETWEEN BEHAVIOR TRAIT RATINGS BY PEERS AND LATER OFFICER PERFORMANCE OF USAF OFFICER CANDIDATE SCHOOL GRADUATES, by Ernest C. Tupes. Oct 57, 41p. 14 refs. AFPTRC TN-57-125; AD-134 257.
Order from LC mi $3.30, ph $7.80 PB 135 903

* National Research Council, 2101 Constitution Avenue, Washington 25, D.C.

The present report describes one of a series of studies aimed at the identification of variables important to successful on-the-job performance of officers and at the development of measures of these variables useful in selection. Peer ratings on 30 personality traits were obtained. Each trait was validated separately against OCS Military Grades, OCS Academic Grades, and later Officer Effectiveness Reports. A majority of the personality trait ratings were found to have substantial validity against each criterion.

Personnel Lab., Lackland Air Force Base, Tex.
A SURVEY OF INCENTIVES FOR HAZARDOUS OR UNPLEASANT WORKING CONDITIONS, by Francis D. Harding. Development rept. Aug 57, 23p. 15 refs. AFPTRC TN-57-115; AD-134 240.
Order from LC mi $2.70, ph $4.80 PB 134 359

A survey of personnel practices within applicable industry and governmental agencies was made to ascertain the kinds of incentives used in motivating people to expose themselves to hazardous or unpleasant working conditions. Attitudes of both management and labor toward the use of incentives were determined. Practices within organizations whose activities involved hazardous or unpleasant conditions were reviewed. Information was collected about present practices within the Armed Services.

Psychological Research Associates [Washington, D.C.]
EVASION AND SURVIVAL PROBLEMS AND THE PREDICTION OF CREW PERFORMANCE, by F. Loyal Greer, Wayne O. Pearson, and M. Dean Havron. Rept. on Contract AF 41(657)65. Dec 57, 63p. 28 refs. AFPTRC TR-57-14; AD-146 426.
Order from LC mi $3.90, ph $10.80 PB 135 921

This report, which has two separately bound supplements, summarizes research and development of a criterion evasion-and-survival field problem designed to reflect in kind and in relative importance the critical situations of a group of men might encounter if they went down behind enemy lines. An effort was also made to identify questionnaire-type instruments that would predict crew performance as measured by the criterion problem. The Crew Survival Capability Test (CREWSCAT) involved a six-hour problem covering a two-mile course. This was administered to 76 crews from USAF Survival Training School. Results for the criterion problem and predictor instruments were analyzed for 60 crews. Comparisons with previous Army studies are made.

Psychological Research Associates, Washington, D.C.
EVASION AND SURVIVAL PROBLEMS AND THE PREDICTION OF CREW PERFORMANCE, SUPPLEMENT I: PREDICTOR INSTRUMENTS, by F. Loyal Greer, Wayne O. Pearson and M. Dean Havron. Rept. on Contract AF 41(657)65. Dec 57. 32p. AFPTRC TR-57-14, Suppl. 1; AD-146 427.
Order from LC mi $3.00, ph $6.30 PB135 921(Sup.)

This research was undertaken to develop a criterion evasion-and-survival field problem that would reflect in kind and in relative importance the critical situations a group of men might encounter if they went down behind the enemy lines. An effort also was made to identify questionnaire-type instruments that would predict crew performance, as measured by the criterion problem. The predictor instruments and scoring keys used in this study of crews from USAF Survival Training School are reproduced here.

Psychological Research Associates, Washington, D.C.
EVASION AND SURVIVAL PROBLEMS AND THE PREDICTION OF CREW PERFORMANCE, SUPPLEMENT II: CREWSCAT PROBLEM FORM AND MANUAL, by F. Loyal Greer, Wayne O. Pearson, and M. Dean Havron. Rept. on Contract AF 41(657) 65. Dec 57, 86p. AFPTRC TR-57-14, suppl. 2; AD-146 428.
Order from LC mi $4.80, ph $13.80 PB 135 921(Sup. 2)

This research was undertaken to develop a criterion evasion-and-survival field problem that would reflect in kind and in relative importance the critical situations a group of men might encounter if they went down behind enemy lines. An effort also was made to identify questionnaire-type instruments that would predict crew performance, as measured by the criterion problem. This supplement contains forms and observation sheets needed by the umpire to evaluate and critique a crew's performance as well as instructions for planning and operating the Crew Survival Capability Test (CREWSCAT) which was developed.

Psychological Services, Inc. [Los Angeles, Calif.]
AN EXPERIMENTAL ANALYSIS OF ACHIEVEMENT IN A GENERALIZED ELECTRONIC TROUBLE-SHOOTING COURSE, by Neil D. Warren, William F. Dossett, and James S. Ford. Rept. on Contract AF 41(657)44. Dec 57, 43p. 16 refs. AFPTRC TN-57-147; AD-146 423.
Order from LC mi $3.30, ph $7.80 PB 135 923

This report summarizes an experimental study of the effects of (a) three levels of generalized training-practice on troubleshooting problems and (b) three levels of general ability (California Test of Mental Maturity) on troubleshooting achievement. Sixteen standardized tests of special abilities were also given. Achievement was measured by scores on a written test designed to measure by conceptual understanding of troubleshooting, and on performance on problems presented in the Generalized Electronic Troubleshooting (GETS) Trainer. Three performance scores were used: number of actions taken, time taken, and a composite score. Subjects were 90 high-school males, 16-19 years old, with mental ages from 156 to 253 months. Apparent relationships of mental age and training level with troubleshooting achievement varied according to the achievement score used. All the achievement

scores were more significantly related to specific mental abilities-especially evaluative reasoning-than to general ability, as measured. Effects of increased practice seemed limited to the more difficult problems. In general, the generalized trouble-shooting training increased efficiency in utilizing symptom information.

Training Aids Research Lab., Chanute AFB, Ill.
RESEARCH INTO BASIC METHODS AND TECHNIQUES OF AIR FORCE JOB ANALYSIS, II, by Jesse C. Rupe and Risdon J. Westen. Nov 55, 81p. 9 refs. AFPTRC TN-55-51.
Order from LC mi $4.80, ph $13.80 PB 136 244

This research was directed toward determining the relative value of these five methods (a) the questionnaire-survey, (b) the group interview, (c) individual interview, (d) observation interview, and (e) technical conference, in the military situation using military analysts and job incumbents.
(See also PB 125 207).

Psychology

Adjutant General's Office, Washington, D.C.
PREDICTION OF SUCCESS IN AUXILIARY SERVICES AND SUPPLY HANDLING COURSES, by W.H. Helme, J.B. Trump, and R.K. White. Dec 57, 15p. 1 ref. PRB Technical Research Note 86.
Order from LC mi $2.40, ph $3.30 PB 135 123

This study was one of a series evaluating the Army Classification Battery (ACB) for effectiveness in predicting success in Army school courses. The objective was to determine the effectiveness of various composites of ACB test scores for predicting performance in Laundry and Dry-Cleaning Machine Operation, Fumigation and Bath Processing, and Supply Handling courses. Scores on the Aptitude Area of selection and scores on an alternate Aptitude Area were compared with final course grades of 1307 enlisted men who attended the courses between between July 1954 and September 1955. In addition, a study was made of the effect of using different cutting scores as prerequisites to entering each course. The current operational Aptitude Area of selection, General Maintenance, was found to be slightly more valid than the alternate for the Laundry course but considerably less valid than the alternate for the Supply course. Both Aptitude Areas had low validity for the Fumigation Course. The low cutting score of 80 failed extremely few in any of the courses. No changes either in the composites or in their cutting scores were recommended for the present.

American Inst. for Research [Pittsburgh, Pa.]
DEVELOPMENT OF TESTS TO MEASURE NONINTELLECTUAL ASPECTS OF OFFICER APTITUDE, by Jack Matthews and Barbara Lupfer. Rept. on Contract AF 33(038)10587. Aug 57, 35p. 5 refs. AFPTRC TR-57-6; AD-134 243.
Order from LC mi $3.00, ph $6.30 PB 135 902

Such factors as personality traits, attitudes, and work habits are recognized as important to the success of an Air Force officer. Practicable measures of these traits that can be related to officer success have not yet been developed. In this investigation the problem was to define areas of non-intellectual officer behavior and to construct paper-and-pencil tests that would predict behavior in these areas. Correlations of the tests with corresponding criterion measures were no higher than with the ratings in other behavior areas. The new tests showed no practical relationship with any of the various criteria.

Army Medical Research Lab., Fort Knox, Ky.
FURTHER INVESTIGATION OF THE INFLUENCE OF WHOLE-BODY VIBRATION AND NOISE ON TREMOR AND VISUAL ACUITY, by M. Loeb. 24 Jan 55, 26p. 11 refs. Rept. no. 165.
Order from LC mi $2.70, ph $4.80 PB 136 861

Subjects were exposed to two amplitudes of vibration at three different frequencies, to 115-db broad-band noise, and to a control condition. Differential effects on visual acuity, manual tremor, and aiming tremor were found during exposure to different frequencies and intensities of vibration. Noise had no apparent differential effects. There were no significant differences in the experimental measures after vibration.

Connecticut U., Storrs.
CULTURAL NORMS FOR VERBAL ITEMS IN 43 CATEGORIES, by B.H. Cohen, W.A. Bousfield, and G.A. Whitmarsh. Technical rept. 22 on Studies on the Mediation of Verbal Behavior, Contract Nonr-631(00). Aug 57, 53p. 3 refs.
Order from LC mi $3.60, ph $0.30 PB 135 888

Institute for Applied Experimental Psychology, Tufts U., Medford, Mass.
AGE AND JUDGMENT OF COLLISION COURSES, by Mason N. Crook, Donald B. Devoe and others. Sep 57, 39p. Rept. no. 57-105.
Order from LC mi $3.00, ph $6.30 PB 136 216

The effect of age from 20 to 50 years on ability to judge whether an approaching aircraft is on a collision course with the subject's aircraft was experimentally investigated. The approaching aircraft was simulated by an image projected onto a viewing screen. Responses were scored for (1) errors and (2) time for correct judgments.

Laboratory of Social Relations, Cambridge, Mass.
MOVEMENT AS A CUE IN PERSON PERCEPTION, by Renato Tagiuri. Rept. on Contract N5ori-076 (70). [1957] 37p. 20 refs.
Order from LC mi $3.00, ph $6.30 PB 136 023

The study of the meaning of movement in very simple symbolic situations appears to be a useful way of bringing to light certain processes of

interference that are too rapid and unconscious in the complex medium of real life or facsimiles of real life. The importance of free movement as a cue derives from the fact that it represents the essence of the unique functional relationship between the person and his field. Since, in ordinary life, the observer is usually fairly well informed about the field conditions, as well as about some of the characteristics of the person, the path of the movement affords an excellent source of information about the "inner state" of the person moving.

Laboratory of Social Relations, Harvard U., Cambridge, Mass.
ON THE VISIBILITY OF CHOICE AND THE AWARENESS OF BEING CHOSEN, by Nathan Kogan and Renato Tagiuri. Rept. on Contract N5ori-076(70). Sep 57, 9p. 10 refs.
Order from LC mi $1.80, ph $1.80 PB 136 022

In these studies the problem is treated as if each of the choices or rejections had similar stimulus value. This is, of course, an assumption convenient only for a first approximation to the problem, for there may be considerable variation in the strength of preferences and dislikes stated under the same set of sociometric instructions.

Michigan U. [Ann Arbor]
MATHEMATICAL PROCEDURES AND MULTIPLE CRITERIA FOR ASSEMBLY OF LARGE WORK GROUPS, by Paul S. Dwyer. Rept. on Contract AF 41(657)9. Oct 57, 26p. AFPTRC TR-57-9; AD-134 255.
Order from LC mi $3.00, ph $6.30 PB 134 616

The present solution is described of the general group assembly problem with the method of reduced matrices when the group scores are known. It provides methods by which the method of reduced matrices may be extended to apply to problems with crews of more than 3 to 5 men and indicates improvements in the details of solution. With slight qualification, the details have been worked out so that it is possible to solve the general group assembly problem quickly on a first class digital computer. Modifications of the method permit the solution of less extensive problems on a less complicated electronic computer. Methods have also been perfected, and codes are available for obtaining good approximate solutions to the group assembly problem in a relatively short time. The general method of reduced matrices is immediately applicable to the general Hitchcock transportation problem and to several other problems in linear programming. With modifications it can be made applicable to a wider class of problems. A slight adaptation mades it possible to find a permutation subset with maximum sum and to solve the general group assembly problem in which one or more of the men trained for some position may be unavailable.

Psychological Lab., Johns Hopkins U., Baltimore, Md.
SEARCH FACTOR IN DETECTING WEAK RADAR TARGETS, by S.B. Williams. Memo rept. on Contract N5ori-166(01). 1 July 47, 12p. Rept. no. 166-I-28.
Order from LC mi $2.40, ph $3.30 PB 136 298

A laboratory investigation of the effect of size of area over which the radar operator searches for targets on the rapidity of detecting incoming targets is reported. The study was restricted to relatively large pips presented on PPI scopes. Furthermore, pips changed only in intensity from scan to scan and not in azimuth or range position. However, care was taken to control factors of psychological expectancy.

BIOLOGICAL SCIENCES

Army Research Office, Washington, D.C.
ANNUAL RESEARCH TASK SUMMARY, 1959. VOLUME 1. BIOLOGICAL, MEDICAL, SOCIAL AND BEHAVIORAL SCIENCES AND OPERATIONS RESEARCH. 322p.
Order from OTS $3.25 PB 151 494

California Inst. of Tech., Pasadena.
REPORT FOR 15 MAY 48-15 JUNE 51 ON [CONTRACT W18-064-cm-207], by Alexander Goetz. 68p. Publication no. 26.
Order from LC mi $3.90, ph $10.80 PB 136 135

Contents:
The application of membrane filters for the microbiological assay of aerosols under field conditions
Memorandum concerning treatment of porous, stainless-steel filter plates
Description of the technique for permanent preservation of used bacteriological membrane filter sampler
Description of tentative methods for staining bacterial deposits upon membrane filters after culturing
Determination of the vertical distribution function of uniform particles retained from hydrosols on the bacteriological membrane filter
Bacteriological performance test on hydrosol assay molecular filters
Membrane filter production plant
Drying and annealing equipment
Bacteriological Membrane Filter Test Laboratory
Sol Control Laboratory
Membrane Filter Control Laboratory (Final Control Laboratory)
Imprinting or embossing counting pattern on membrane filters

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DISPOSABLE ANALYZER FOR SEMIQUANTITATIVE DETERMINATION OF CARBON MONOXIDE IN BLOOD, by N. Burr Furlong. Rept. on Detection and Measurement of Toxic Chemicals. Sep 57, 9p. WADC TR-57-604; AD-142 013.
Order from LC mi $1.80, ph $1.80 PB 135 883

A disposable blood-carbon monoxide analyzer with which it is possible to make relatively accurate measurements has been developed. Use of this device requires no additoinal apparatus or training. The analyzer is described and the method of operation is presented.

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EXTENDING HUMAN TOLERANCE TO HEAT BY PRIOR BODY COOLING, by James H. Veghte and Paul Webb. Sep 58, 20p. 17 refs. WADC Technical rept. 58-412; AD-205 544.
Order from OTS $0.50 PB 151 469

A preliminary study has been completed to determine the effect of prior body cooling on tolerance to a high level of heat stress. Subjects were exposed to three levels of precooling— -30-, 60-, and 90-minute exposures in a 60° F water bath— — prior to entering the heat chamber at 160° F. As the time of precooling increases, the average tolerance time in heat is correspondingly greater. At tolerance, a narrow spread of terminal rectal temperatures is observed. Recruitment of sweating in heat is inhibited by prior body cooling. The causative factors for this phenomenon are discussed.

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
PSYCHOLOGIC AND BIOELECTRIC ASSESSMENT OF G-SUIT PROTECTION, by Albert J. Silverman, Sanford I. Cohen and others. Rept. on Aircrew Fatigue on Extended Missions. Oct 58, 13p. 5 refs. WADC Technical note 56-400; AD-97 278.
Order from OTS $0.50 PB 151 476

Performance of a psychomotor task and arousal as measured by GSR were assessed on six subjects who were centrifuged at 3 g for ten rides, while protected and again while unprotected by an anti-g suit. Results suggested less arousal and better sustained performance when protected by the suit.

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AN ELASTIC TUBE THEORY OF PULSE TRANSMISSION AND OSCILLATORY FLOW IN MAMMALIAN ARTERIES, by John R. Womersley. Jan 57, 135p. 23 refs. WADC Technical rept. TR-56-614; AD-150 242.
Order from OTS $2.75 PB 151 356

This work develops the concept of a thin walled elastic tube as a rough working model of an artery, and from a solution of the equations of motion of such a tube, filled with viscous liquid, a number of relationships are deduced that can be tested experimentally. The theory of pulse-wave transmission, and the relationships between pulse pressure, rate of flow, and radial expansion, are demonstrated as parts of a single logical structure. Some comparisons with experimental results are made, and new experiments are proposed, as tests of the adequacy of the theory.

Army Medical Research Lab., Fort Knox, Ky.
INFLUENCE OF HIGH INTENSITY NOISE ON VISUAL THRESHOLDS, by Paul D. Coleman and John Krauskopf. 22 Feb 56, 34p. 37 refs. Rept. no. 222.
Order from LC mi $3.00, ph $6.30 PB 136 863

Visual thresholds taken during noise and quiet conditions were not significantly different. Variation in the noise intensity between 110 db (re. .0002 dynes/cm^2) and 140 db failed to produce any significant effect on visual thresholds. Thresholds of individual subjects, however, were changed significantly during the noise condition. Some subjects had higher thresholds during noise, other had lower thresholds. The subjects' thresholds during noise appeared to be influenced by spurious information about previous performances during noise.

Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
STUDY OF THE USE OF AUTOMATIC GAS ANALYSIS TO DETERMINE RESPIRATORY EFFICIENCY, by Clayton S. White, Loren C. Watkins, Jr. and Edward E. Fletcher. Final rept. on Contract AF 18(603)80. 21 Apr 58, 32p. 35 refs. AFOSR TR-58-58; AD-154 295.
Order from LC mi $3.00, ph $6.30 PB 135 999

A small circular quartz tube fitted with flat external metal electrodes and energized with an RF oscillator at 3.0 mc stabilized to minimize harmonics was employed as a light source on a Beckman DU Spectrophotometer to explore the calibration characteristics of oxygen emission near 7772-74-75 A. Calibration curves for up to almost 100% dry oxygen in nitrogen were curvilinear; up to about 20% oxygen, the relation between emission output and oxygen concentration was essentially linear. The presence of dry carbon dioxide in dry oxygen-nitrogen mixtures yielded complex calibration curves for oxygen whereby oxygen activity was enhanced and depressed by small and large amounts of carbon dioxide, respectively. A small rectangular quartz tube fitted with recessed flat rectangular external metal electrodes and energized with an RF oscillator at 3.0 mc was employed with the Beckman DU spectrophotometer to analyze carbon dioxide near 2896 A. Near this wavelength, the analyzer yielded linear curves for carbon dioxide mixtures in air, but was not specific for carbon dioxide in that nitrogen effects were also noted. The analyzer was not

judged adequate for routine use in respiratory physiology.

Milan U. (Italy).
PROLONGED AFTER-EFFECT OF CENTRIPETAL AND TANGENTIAL ACCELERATIONS ON CEREBELLAR POTENTIALS. Final rept. 1 Jun 56-30 Sep 57, on Contract AF 61(514)968. 6p. AFOSR TR-58-37; AD-152 246.
Order from LC mi $1.80, ph $1.80 PB 136 035

It appears that the cerebellar cortex of birds is highly sensitive to rotatory acceleration. A response is obtained at a value as low as 0.01-0.02 g, the stimulation of the cerebellar neurons being due to changes of the sensory inflow coming from the labyrinth. In fact, bilateral labyrinthectomy completely abolished the cerebellar response. A mechanism different from the one producing nystagmus is, however, most likely for the cerebellar response since (1) the threshold for cerebellar response is lower than that for nystagmus and (2) cerebellar response is present in curarized animals. The main finding of this research consists in the difference in the cerebellar post-rotatory activity of homing pigeons and migratory birds in contrast to that found in domestic and non-migratory species.

National Research Council, Washington, D.C.
CONFERENCE ON HEMOGLOBIN, 2-3 May 1957. 1958, 315p. 583 refs.
Order from NRC* $3.00 NRC pub 557

Contents:
Part 1. Structure of hemoglobin
Part 2. Biosynthesis of hemoglobin
Part 3. Abnormal hemoglobins
Part 4. Genetic aspects of abnormal h moglobins
Part 5. Clinical characteristics associated with abnormal hemoglobins

Pennsylvania State U., University Park.
SURVEY OF HEARING IN A LOW INDUSTRIAL NOISE-LEVEL POPULATION, by John F. Corso. Final rept. 1 Aug 54-31 Jan 58, on Conducting a Hearing Survey on a Population in a Low Industrial Noise-Level Community, Contract AF 33(616)2626; Continuation of Contract AF 33(038)786. Oct 58, 112p. 58 refs. WADC Technical rept. 58-442; AD-204 799.
Order from OTS $2.50 PB 151 460

This report summarizes a series of studies performed in conducting a survey to evaluate the hearing characteristics of a population exposed to minimal levels of industrial noise. Each of the studies reported contains a section on purpose, procedures, tests and instructions, results and conclusions. The basic topics covered relate to the threshold of hearing for pure tones as measured by different audiometric techniques, the threshold of hearing for speech, and the discrimination loss of speech. The results of the survey are presented in terms of normal threshold values and provide an adequate basis from which hearing loss due to noise exposure may be evaluated. It is recommended that the present standards of normal hearing be reestablished to account for the factors of age and of sex as important determinants of hearing ability.

Quartermaster Research and Engineering Center, Natick, Mass.
A PORTABLE, DIRECT-READING THERMISTOR THERMOMETER FOR MEASURING RECTAL TEMPERATURE, by John R. Breckenridge. May 58, 16p. 12 refs. Technical rept. EP-89.
Order from LC mi $2.70, ph $4.80 PB 135 112

A highly portable, direct-reading system for the accurate measurement of rectal temperature on physically active subjects is described. The system utilizes (1) a rugged molded rubber catheter containing a thermister sensing element and (2) a simple indicator with a range of 95° to 105°F designed around a d-c- measuring bridge circuit. Necessary circuits details are given for the indicator, both when used separately and as an external unit for driving single-and multipoint recorders. The allowable tolerances for the various components consistents with a measurement accuracy of ±0.1F° are established and the importance of other sources of error is analyzed.

School of Aviation Medicine, Randolph AFB, Tex.
IONIC THERMOCOUPLE THEORY OF THE MECHANISM OF THERMAL SENSIBILITY, by Clyde M. Williams. Mar 58, 17p. 40 refs. Rept. 58-53.
Order from LC mi $2.40, ph $3.30 PB 135 448

A modification of the spatial intracutaneous gradient theory of Ebbecke and Bazett is proposed to account for the electrophysiologic observations of Zotterman and Hensel on the properties of thermal receptors. This modification explains the discharge of thermal receptors on the basis of an analogy with the mechanism by which anisothermal conditions produce an electromotive force in an electronic thermocouple.

School of Aviation Medicine, Randolph AFB, Tex.
SURGICALLY PRODUCED ARTERIAL LOOPS FOR DETERMINING BLOOD PRESSURES IN EXPERIMENTAL DOGS, by Harry A. Gorman and Roger A. Yeary. Aeromedical Reviews May 58, 6p. Review 5-58.
Order from LC mi $1.80, ph $1.80 PB 135 958

School of Aviation Medicine, Randolph AFB, Tex.
VOLUNTARY VENTILATION CAPACITY: NORMAL VALUES AND RELIABILITY OF MEASUREMENT, by John S. Gray and Earl L. Green. 4 Dec 45 [13]p. 14 refs. Proj. no. 449, rept. no. 1; AD-135 536.
Order from LC mi $2.40, ph $3.30 PB 135 688

* National Research Council, 2101 Constitution Avenue, Washington 25, D.C.

A method has been standardized for measuring the voluntary ventilation capacity of human subjects. Repeated tests in eighty-nine aviation students revealed the reliability coefficient of the test to be 0.90. The mean ventilation capacity was found to be 168 l/min. with a standard deviation of 22 l/min. The ventilation capacity was found to be correlated with surface area, but not with age, height, or weight. A regression equation was obtained from which the normal ventilation capacity may be predicted from a knowledge of the surface area with a standard error of estimate of 15 l/min. This test should be clinically useful as a ventilatory function test of the respiratory system.

Biochemistry

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THE DEMONSTRATION OF SUCCINIC DEHYDROGENASE IN SINGLE TISSUE ELEMENTS OF THE CENTRAL NERVOUS SYSTEM, by Reinhard L. Friede. Rept. on Health Hazards of Materials and Radiation. Aug 58, 11p. 9 refs. WADC Technical rept. 58-417; AD-155 844.
Order from OTS $0.50 PB 151 491

Succinic dehydrogenase was demonstrated by histochemical tetrazolium technique in single tissue elements obtained from different regions of the central nervous systems of rats and guinea pigs. Different, but characteristic, enzyme concentrations were found in neurons, neuropil, glia cells, axons, capillary vessels, and ependyma. The enzyme content of the neurons varies greatly, and neurons with enzyme activity weaker than the surrounding neuropil seem characteristic for some regions of the brain.

Army Medical Nutrition Lab., Denver, Colo.
MEASUREMENT OF LOW LEVELS OF CLEARING FACTOR IN BLOOD. I: STUDIES ON THE CLEARING FACTOR ASSAY, by W.W. Cleland and J.M. Iacono. 17 June 58, 19p. 10 refs. Rept. 222.
Order from LC mi $2.40, ph $3.30 PB 135 967

Hydrolysis of fat emulsion by clearing factor in serum is essentially a zero order reaction with excess substrate present at 37°C. Determination of the liberated glycerol is greatly improved by prior deproteinization of the serum. Consequently, the clearing factor activity can be determined with considerable accuracy.

Army Medical Nutrition Lab., Denver, Colo.
MEASUREMENT OF LOW LEVELS OF CLEARING FACTOR IN BLOOD. II: LEVELS OF FASTING AND LIPEMIC SERUM, by W.W. Cleland, Lucille P. Wendell, and J.M. Iacono. 17 June 58, 13p. 12 refs. Rept. 223.
Order from LC mi $2.40, ph $3.30 PB 135 966

In rabbits and human beings, healthy and ill, the infusion of fat emulsion produces an increase in the level of circulating clearing factor, which increase, however, is only sufficient to account for the removal of 5 per cent of the fat which actually leaves the circulation.

Pharmacology and Toxicology

Armed Services Medical Procurement Agency, Brooklyn, N.Y.
PREVENTION OF DETERIORATION: GLYCERIN, USP, 10 lb. FSN 6505-153-8219, by Max Feinberg and R.F. Thompson. Dec 56, 5p. Memo. rept. no. 57-6.
Order from OTS $0.50 PB 151 012

Purpose was to investigate the factors causing deterioration in storage of glycerin in cans, and to investigate and devise methods to prevent or retard such deterioration.

Army Chemical Warfare Labs., Army Chemical Center, Md.
TOXICITY STUDIES OF NAVEE 427, AN AIRCRAFT DEGREASER AND CARBON REMOVER, by Sidney Rothberg, Robert Paine, and Joseph L. Colbourn. Rept. CWLR 2001 (Revised). Mar 58, 16p. 7 refs. Rept. CWLR 2001 (Rev.)
Order from LC mi $2.40, ph $3.30 PB 136 029

On the basis of experiments to test Navee 427 on animals, the oral and inhalation hazards to man are expected to be slight. On the other hand, ocular and cutaneous damage are possible. Splashing of the eyes and excessive skin contact must be avoided or personal protective equipment provided or both. Adequate amounts of water should be available for decontamination.

Chemical Corps Medical Labs., Army Chemical Center, Md.
CONFERENCE ON THE HEALTH HAZARDS OF MILITARY CHEMICALS, by Stephen Krop. Aug 54, 52p. Special rept. no. 48.
Order from LC mi $3.60, ph $9.30 PB 135 244

The report comprises the proceedings of a conference for the purpose of reviewing past accomplishments and current investigations, and for the planning of future work.

Radiobiology

Albert Einstein Medical Center, Philadelphia, Pa.
BEHAVIOR OF THE RADIATION PROTECTIVE AGENT AET IN HUMAN SERUM IN VITRO, by Bernard Shapiro. June 58, 15p. 5 refs. AFSAM 58-91.
Order from LC mi $2.40, ph $3.30 PB 135 947

The behavior of AET in human serum was studied

by utilizing paper chromatography, paper electrophoresis, and S^{35} labeled AET of high specific activity. On addition of crystalline S^{35} AET to serum, MEG, guanidinoethyl disulfide, and 2-AT are formed and a large portion of radioactivity is bound to the protein. These forms are highly stable and do not change on standing or with irradiation, except in extraordinarily large doses. Addition to human serum of AET in buffered solution containing only MEG and guanidinoethyl disulfide gives the same results as with crystalline AET except that no 2-AT is found. These studies may indicate failure of the radical capture process by products of AET in serum. However, these results do not reveal the in vivo situation which may be completely different.

Brooke Army Medical Center, Fort Sam Huston, Tex.
PRINCIPLES OF NURSING CARE IN THE MANAGEMENT OF BURNED PATIENTS, by Betty L. Colyer and Juana J. Cox and Edward H. Vogrl, Jr. Research rept. Nr. 4-58. Apr 58, 25p. 10 refs. Research rept. no 4-58.
Order from LC mi $2.70, ph $4.80 PB 135 954

Nurses need specific training and a knowledge of the problems involved in proper management of burned patients. Initial therapy is guided by an evaluation of the extent and depth of the burn. The "Rule of Nines" is a quick method of calculating the percentage of extent of body surface involvement. Early procedures include shock treatment, fluid-loss replacement, and antibiotic prophylaxis. Tracheotomy may be lifesaving in respiratory obstruction. Operative procedures include debridement, dressing changes, and skin grafting. Autograft and, if necessary, homograft skin is used on patients sustaining extensive, full-thickness injury. Donor sites are treated by the exposure method. At times, psychological disturbances delay recovery and require supportive therapy. Physical and occupational therapy are employed as soon as practicable; and they hasten restoration of function. The patient, completely dependent during the early phases of his hospitalization, becomes self-reliant.

School of Aviation Medicine, Randolph AFB, Tex.
BIOLOGICAL AND MEDICAL EFFECTS OF IONIZING RADIATION II. EFFECT OF EARLY EXSANGUINO-TRANSFUSION ON X-IRRADIATED DOGS, by Charles P. Powell and Herbert B. Gerstner. June 52, 11p. 25 refs. Project no. 21-47-005, rept. no. 2.
Order from LC mi $2.40, ph $3.30 PB 135 459

An exsanguino-transfusion method for dogs has been developed that enables the replacement of more than 90 percent of the recipient's blood by stored donor blood. This procedure was employed in 20 dogs within three hours following exposure to a lethal dose (420 r) of total body x-radiation. Clinical observations and laboratory examinations of these animals were compared with the findings obtained in 20 untreated control dogs exposed to an equal amount of irradiation. No significant differences between th treated and the untreated groups were found in the general clinical course, in most of the laboratory studies, nor in survival time. Following irradiation, a marked leukocytosis occurred in the transfused dogs throughout a period of two days, in sharp contrast to the leukopenia seen in the untreated control animals.

School of Aviation Medicine, Randolph AFB, Tex.
MILITARY AND CIVIL DEFENSE ASPECTS OF THE ACUTE RADIATION SYNDROME IN MAN, by Herbert B. Gerstner. Nov 57, 30p. 54 refs. Rept. 58-6.
Order from LC mi $2.70, ph $4.80 PB 136 080

From a comparative analysis of human data derived from nuclear accidents, Japanese bomb casualties, and radiotherapy patients, emerges the clinical picture of the acute radiation syndrome with its three subdivisions -- hematopoietic, gastrointestinal, and cerebral forms. Dependency of the picture on dose level and individual susceptibility is discussed, and the therapeutic management is outlined. Since penetrating ionizing radiation represents a potential casualty-causing agent, problems facing the practical physician under catastrophic conditions are evaluated.

USAF Radiation Lab., U. of Chicago, Ill.
QUARTERLY PROGRESS REPT. NO. 23. Contract AF 41(657)25. Apr 57, 98p. 53 refs.
Order from LC mi $5.40, ph $15.30 PB 135 622

Contents:
The effects of ionizing radiations on the biochemistry of mammalian tissues
- I. The effects of S, β-aminoethylisothiuronium dichloride (AET) and β-mercaptoethylamine (MEA) on sulfhydryl enzymes
- II. The effect of β-aminoethylisothiuronium (AET) on the adenosine triphosphatase activity of the hematopoietic tissues of irradiated animals
- III. The injurious effects of acutely toxic doses of X-radiation following daily exposure to low doses of X-ray

Pharmacological and toxicological compounds as protective or therapeutic agents against radiation injury in experimental animals
- I. The influence of various chemical compounds on radiation lethality in mice

The influence of exposure to low levels of gamma and fast neutron irradiation on the life span of mice
- I. Preliminary results of the effects of chronic exposure of mice to neutron and gamma radiation

CHEMISTRY

Army Research Office, Washington, D.C.
ANNUAL RESEARCH TASK SUMMARY, 1959.

VOLUME 2. CHEMISTRY. 212p.
Order from OTS $2.00 PB 151 495

Analytical Chemistry

Naval Ordnance Test Station, China Lake, Calif.
MASS SPECTRA OF NITRATE ESTERS, NITRATE ESTERS, NITRO COMPOUNDS AND SEVERAL OTHER NITROGEN COMPOUNDS, by Robert Boschan and S. Ruven Smith. July 57, 41p. NOTS-1670; NAVORD rept. 5412.
Order from OTS $1.25 PB 151 120

Examination of the mass spectra of a large number of oxygenated nitrogen compounds, including nitro compounds, nitrate esters, nitrite esters, and nitramines, revealed certain correlations that may prove useful in the characterization of unknown compounds of these types or in the identification of components of an unknown mixture. Assignments have been made for the ion fragments resulting from rupture of the parent compounds in the electron beam, and an attempt has been made to associate the presence of certain prominent peaks in the mass spectra with structural features of the parent compound. Appendix B contains the complete cracking patterns of all the compounds studied, their sensitivities, and the butane-comparison spectra.

Naval Ordnance Test Station, China Lake, Calif.
POLAROGRAPHIC DETERMINATION OF STYRENE MONOMER IN POLYESTER RESINS, by Gerald C. Whitnack and William M. Ayres. Interim rept. Sep 57, 13p. 6 refs. NOTS 1659; NAVORD rept. 5404.
Order from LC mi $2.40, ph $3.30 PB 135 320

A polarographic method of analysis is presented as a quick and precise way to analyze for styrene monomer in polyester resins. An ethanolic solution of the resin is polarographed in a tetrabutylammonium chloride supporting electrolyte (75% ethanol). Dissolved oxygen need not be removed prior to recording the polarogram. Data indicate that the analysis has a precision of about 5 parts per thousand and the presence of phthalate and fumarate or maleate esters does not interfere.

Rock Island Arsenal Lab., Ill.
ZINC, IRON, AND PHOSPHORUS ANALYSIS IN A HOT ZINC PHOSPHATING BATH USING THE EMISSION SPECTROGRAPH, by J.W. McGarvey. Mar 58, 13p. 7 refs. Rept. no. 58-417.
Order from LC mi $2.70, ph $.80 PB 135 568

An efficient analytical method was developed for the analysis of zinc, iron, and phosphorus in a hot zinc phosphating bath as a key to the evaluation of various phosphatizing variables by radiometric techniques. The use of this method should also result in improved shop operation and producibility because it affords a closer and more efficient control of the concentrations of zinc, iron, and phosphorus than present wet analytical methods. The emission spectrographic working curves for the analysis of zinc, iron and phosphorus were constructed by using suitable synthetic standards which were designed to cover the concentration ranges of these elements in a typical hot zinc phosphating bath.

Watertown Arsenal Labs., Mass.
BISMUTHATE METHOD FOR THE DETERMINATION OF MANGANESE IN TITANIUM, by F.P. Valente. Technical rept. on Ordnance Structural Materials. Jan 58, 11p. 5 refs. WAL TR-401/289.
Order from LC mi $2.40, ph $3.30 PB 135 430

The object of this study was to determine the feasibility of analyzing titanium-base alloys for manganese by a bismuthate method.

Inorganic Chemistry

Baylor U., Waco, Tex.
THE CHEMISTRY OF THE LOWER VALENCES OF TITANIUM, by Thomas C. Franklin and Haig Verne Seklemian. Rept. on Contract AF 33(616) 3331. Sep 58, 63p. 113 refs. WADC Technical rept. 58-349; AD-155 694.
Order from OTS $1.75 PB 151 485

A study was conducted to identify and characterize the lower valence states of titanium (normally tetravalent), with a particular view to establishing whether divalent compounds do in fact have stable existence. Several methods for the preparation of divalent titanium were investigated: disproportionation of titanium tetrabromide, reduction of titanium tetrachloride, dissolution of the metal in aqueous and anhydrous acids, and the anodic dissolution of the acid in various non-aqueous solvents. These techniques failed to produce identifiable quantities of divalent compounds. Solubility and reaction studies were made by extracting commercial "titanium dichloride" with a number of typical solvents. This substance is insoluble in non-polar liquids; in polar solvents, or those containing labile hydrogen atoms, slow reactions appear to accompany dissolution; with water, reaction is immediate and hydrogen is evolved. Absorption spectra of these solutions give peaks characteristic of tri- and tetravalent titanium. No other peaks are observed. It is concluded that divalent titanium does not exist to any appreciable extent in solution, and that much of the literature on alleged divalent compounds is probably describing a corresponding trivalent substance. Electrochemical experiments, using both dissolution and deposition techniques, confirm the observation that the lowest stable valence of titanium in solution is three.

Western Electrochemical Co., Culver City, Calif.
ELECTROLYTIC PRODUCTION OF BATTERY ACTIVE MANGANESE DIOXIDE, by Joseph C. Schumacher and Roger W. Hoffmann. Final rept. for 21 July 50-31 Dec 52 on Pilot Run Industrial

Preparedness Study, Contract DA 36-039-sc-716. 31 Mar 54, 189p. 79 refs.
Order from LC mi $8, 40, ph $30.30 PB 138 294

Westinghouse Electric Corp., East Pittsburgh, Pa.
INVESTIGATION OF THE REACTION OF MANGANESE AND BISMUTH BY DIFFERENTIAL THERMAL ANALYSIS, by A. Goldman and G.I. Post. Rept. on Solid State Research and Properties of Matter, Contract AF 33(616)309, Aug 58, 21p. 8 refs. WADC Technical Note 58-254; AD-155 887.
Order from OTS $0.75 PB 151 444

The reaction between powdered manganese and bismuth was investigated by differential thermal analysis. The D.T.A. data, when combined with other results, provided information on the nature of the reaction. A small amount of reaction occurred below the eutectic temperature (262°C), but most of it took place between 262°C and 271°C. The melting of the bismuth-rich alloy produced the major thermal effect in the reaction region. Other thermal changes were noted for temperatures from 300°C to above 360°C. A differential thermal analysis was also made on a sample containing the high temperature phase of manganese bismuthide.

Organic Chemistry

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
INHIBITION OF HYDROGEN EMBRITTLEMENT DURING PICKLING: SYNTHESIS OF 6-METHYL-3 (P-TOLYL) 3.4.-DIHYDROQUINAZOLINE, by J. Sprague. Nov 57, 17p. 9 refs. Rept. no. CCL# 39.
Order from LC mi $2.40, ph $3.30 PB 135 341

The substance 6-Methyl-3-(p.tolyl)-3.4-dihydroquinazoline has been isolated as a principal component of the hydrogen embrittlement inhibitor described in MIL-A-13528 (ORD) (originally U.S. Army 4-105). The object of this study was to develop a commercially feasible synthesis of this compound.

Naval Ordnance Lab., Corona, Calif.
HIGH TEMPERATURE DIELECTRIC MATERIALS Interim rept. no. 6, July-Sep 54. Dec 54, 18p. Rept. no. 230; AD-115 987.
Order from LC mi $2.40, ph $3.30 PB 136 677

Studies of the polymerization of diphenylvinylsilane were conducted. The difficulties previously encountered in making perfluoromethyliodophosphines in stainless steel equipment have been overcome by scrupulous cleaning and drying of all equipment and reactants. Greatly increased conversion of perfluoromethyl iodide has been obtained by two modifications of the reaction: first by substitution of the yellow phosphorus by red phosphorus, and second by the addition of iodine to the yellow phosphorus.

Purdue U., Lafayette, Ind.
ALIPHATIC NITRO COMPOUNDS AND THEIR DERIVATIVES, by Nathan Kornblum. Final rept. for 2 June 52-31 Oct 57 on Contract AF 18(600)310. Nov 57, 10p. AFOSR TR-58-62; AD-158 233.
Order from OTS $0.50 PB 131 990

Lists papers resulting from work under this contract and summarizes research accomplished.

University of Southern California, Los Angeles.
SODIUM SALTS OF TRI-α-NAPHTHYLBORON, by Carl W. Moeller and W.K. Wilmarth. Rept. on Contract N6onr-238(04). Sep 57, 17p. 16 refs.
Order from LC mi $2.40, ph $3.30 PB 135 728

Tri-α-naphthylboron reacts with an equivalent of sodium in tetrahydrofuran to form the paramagnetic tri-α-naphthylboron radical anion. Magnetic susceptibility measurements and molecular weight determinations indicate that the diamagnetic dimer forms in ethyl ether. The solid monosodium salt is also diamagnetic, as is the disodium salt in ether and tetrahydrofuran. The effect of solvent is discussed.

Physical Chemistry

American Electro Metal Div., Firth Sterling, Inc., Yonkers, N.Y.
NEW HIGH TEMPERATURE INTERMETALLIC MATERIALS, by R.D. Grinthal. Rept. for 1 Mar 57-28 Feb 58 on Ceramic and Cermet Materials, Contract AF 33(616)5088. May 58, 80p. 32 refs. WADC Technical rept. 53-190, pt. 6; AD-155 814.
Order from OTS $2.25 PB 151 353

In the search for new high temperature materials, an investigation of new intermetallic compounds was conducted, including five ternary systems and a number of binary rare earth intermetallic compounds. Addition of Mo to Cr_2Ti improved its strength behavior. Addition of Cr, Ti, or Nb to NiAl did not significantly improve its mechanical properties but not its oxidation resistance. X-ray identification and in some cases physical properties of the rare earth aluminides and silicides are presented.

Armour Research Foundation, Chicago, Ill.
PHASE RELATIONSHIPS IN THE SYSTEM IRON-ALUMINUM-OXYGEN, by Leon M. Atlas and William K. Sumida. Rept. for 1 Oct 55-30 Sep 56 on Ceramic and Cermet Materials, Contract AF 33(616)3195. Feb 57, 56p. 28 refs. WADC TR-56-587; AD-118 306.
Order from OTS $1.50 PB 151 000

Review of literature and experimental results. Five compounds recognized are wustite ($Fe_{1-x}O$), iron spinel (Fe_3O_4 - $FeAl_2O_4$), Fe_2O_3, Al_2O_3, and $Fe_2O_3 \cdot Al_2O_3$. Solid solution fields are presented.

Illinois U., Urbana.
OBSERVATIONS ON THE RARE EARTHS: ELECTROCHEMICAL STUDIES INVOLVING ANHYDROUS PYRIDINE AND ACETONITRILE SOLUTIONS, by Therald Moeller and Gynith Giffin. Rept. on Contract AF 18(600)1535. 1 Aug 58, 104p. 65 refs. AFOSR TN-58-589; AD-162 113.
Order from LC mi $5.70, ph $16.80 PB 136 162

The reaction LaO with HBr at elevated temperatures to produce anhydrous LaB was investigated as a method of preparing other rare earth bromides. Br gas introduced into the reaction with the HBr flow was essential for complete reaction. The preparation of bromides by the reaction of HBr with anhydrous rare earth benzoates was also investited. X-ray diffraction patterns of the bromides were of 3 types. La and Pr bromides were isomorphous, as were Nd and Sm bromides. Gd Br exhibited a third, unidentified structure type. The bromides are moderately soluble in pyridine and slightly soluble in acetonitrile. The solubilities of anhydrous Ca, St, and Ba bromides were also determined in pyridine. Crystalline solvated rare earth bromide phases were formed in both solvents during solubility studies. The acetonitrile addition compounds corresponded to the formula, $LnBr_3.xCH_3CN$, where x is 3for La, Nd, and Gd, 4 for Sm, and 5 for Pr. The rare earth bromides were found to be weak electrolytes in both acetonitrile and pyridine. The bromides were better conductors in acetonitrile than in pyridine. Ca, St, and Ba bromides and neodymium benzoate were found to be weak electrolytes in pyridine. The absorption spectra of neodymium and praseodymium bromides in acetonitrile and pyridine, as compared with those in aqueous solutions, showed slight shifts in wavelengths of absorption bands, changes in intensities, and in the case of Md, resolution of various bands. The spectrum of neodymium benzoate in pyridine exhibited similar changes.

Lincoln Lab, , Mass. Inst. of Tech., Lexington.
SOME STUDIES ON GROUP III-V INTERMETALLIC COMPOUNDS, by Carol R. Kolm. Rept. on Contract AF 19(122)458. 20 Feb 57, 32 refs. Technical rept. no. 150.
Order from LC mi $3.30, ph $7.80 PB 133 892

A study employing infrared absorption, electrical resistivity, Hall, and lattice parameter measurements. Si, Ge, Sn, and Pb are soluble in GaAs to the extent of approximately one-half an atomic per cent. The Group IV elements Si, Ge, Sn, and Pb were also added to the compound InSb, and all of these elements were found to produce a shrinkage of the InSb lattice. InSb containing either Si or Ge was found to be opaque over the 1-10 micron wavelength region. The InSb-GaSb system was also investigated and the solubility of either compound in the other was found to be about 10 per cent. It is concluded that the forbidden energy gap depends not only on the interatomic spacing, but also on the types of bonding present and their mutual interaction.

Massachusetts Inst. of Tech. Cambridge.
MECHANISM OF CATALYTIC DECOMPOSITION OF H_2O_2 SOLUTIONS WITH MANGANESE DIOXIDE, by D.B. Broughton, R.L. Wentworth and others. Rept. no. 1 on Contract NOrd-9107. 1 Nov 45, 35p. DIC-6351; ATI-37775.
Order from LC mi $3.00, ph $6.30 PB 136 233

Progress report is given on the mechanism of catalytic decomposition of H_2O_2 with MnO_2, using radioactive manganese as a tracer, indicates that the decomposition proceeds by alternate reduction and reoxidation of manganese. Measurements of the relative quantities of $MnSO_4$, and KOH required to initate catalytic decomposition and similar measurements with $KMnO_4$, have been made. Results show that the reoxidation of manganous manganese does not occur until the solution is saturated with $Mn(OH)_2$, although free energy values favor reoxidation, even at extremely low Mn concentrations.

National Bureau of Standards, Washington, D.C.
THERMAL CONDUCTIVITY AND HEAT CAPACITY OF MOLTEN MATERIALS: PART 1. HEAT CAPACITY OF LUTHIUM FLUORIDE FROM 0°C to 900°C, by Thomas B. Douglas and James L. Dever. Rept. on Contract AF 33(616)52-10. Oct 53, 31p. 11 refs. WADC TR-53-201, pt. 1; AD-22 234.
Order from LC mi $3.00, ph $6.30 PB 136 845

The relative enthalpy of lithium fluoride was measured from 0° to 900°C. Measurements show a heat of fusion of 1043.6(±5) absolute joules per gram and a melting point of 848°C(±1°).

National Burauu of Standards, Washington, D.C.
THERMAL CONDUCTIVITY AND HEAT CAPACITY OF MOLTEN MATERIALS. PART 3. THE HEAT CAPACITY OF MOLYBDENUM DISILICIDE FROM 0° to 900°C, by Thomas B. Douglas and William M. Logan. Rept. on Contract AF 33(616)52-10. Oct 53, 18p. 5 refs. WADC Technical rept. 52-201, pt. 3; AD-24 019.
Order from LC mi $2.40, ph $3.30 PB 137 099

The enthalpy relative to 0°C of a sample of molybdenum disilicide ($MoSi_2$) was measured. The equation was derived:

$$Cp=0.019 + 4.32(10^{-5})t - 1.70(10^{-8})t^2.$$

giving the heat capacity in calories per gram-deg C at t°C between 0° and 900°C. Values of the enthalpy, heat capacity, and relative entropy derived from this equation are formulated and tabulated.

Ohio State U. Research Foundation, Columbus.
MECHANSIM OF THE OXIDATION OF HYDROCARBONS, by Cecil E. Boord. Final rept. for 15 Sep 55-Apr 58 on Contract AF 18(600)787. Apr 58, 122p. 48 refs. AFOSR TR-58-82. AD-158 384.
Order from OTS $2.75 PB 151 016

The subjects include: kinetics of the reaction of oxygen with liquid cyclohexene, gas phase oxidation of cyclohexene, liquid phase oxidation of cyclohexene

in teflon containers, kinetics of the low-temperature gas phase oxidation on n-pentane in a static system, liquid phase oxidations, alkyl hydroperoxides in vapor phase oxidation hydrocarbons, flash thermal decomposition of peroxides, the chemical shock tube in oxidation of hydrocarbons, study of preflame reactions in a motored engine, chemical reactions in the preflame phenomenon, organic hydroperoxides from dienes and diols, gas chromatography and cool-flame studies, study of the gas phase oxidation of hydrocarbons, polarographic analysis and research, infrared analysis and research, and detailed reaction mechanism for the cool-flame combustion of n-hexane.

Rome Air Development Center, Griffiss AFB, N.Y.
SURVEY OF ADSORPTION PHENOMENA IN THE GAS-SOLID PHASE, by Wilburt Herbener. Feb 58, 25p. RADC TN-58-32; AD-148 560.
Order from OTS $0.75 PB 151 006

An abridged review of adsorption theory and phenomena pertaining to the gas-solid interface is presented. Special emphasis is placed on multicomponent vapor adsorption with solid absorbents, the factors of which effect said adsorption. Application of the original and modified Polyani Adsorption Potential Theory to multicomponent vapor adsorption is also described.

Stanford Research Inst., Menlo Park, Calif.
FURTHER CALCULATIONS OF GASEOUS ALKALI HALIDE SPECIES. Part A: CALCULATION OF THE ENERGIES OF SOME ALKALI HALIDE TRIMERS. Part B: ENERGIES OF ALKALI HALIDE M_2X^+ MOLECULE IONS, by Thomas A Milne and Daniel Cubicciotti. Technical note no. 3 on Contract AF 49(638)89. Feb 58, 11p. 11 refs. AFOSR TN-58-592; AD-162 116.
Order from LC mi $2.40, ph $3.30 PB 136 160

The application of the simple Pauling model to the calculation of the binding energies of $MX(g)^4$ and $M_2X_2(g)^5$ was extended to include the case of $M_3X_3(g)$. The energies of 6-membered planar ring structures for alkali halides were calculated with the Pauling model. The minimum energies and the corresponding distances were determined by repeatedly substituting sets of arbitrary values, differing by 0.05 A, of the distance parameters into the equation and calculating the energy until a minimum was obtained. The energies of alkali halide M_2X^+ molecule ions were also calculated

EARTH SCIENCES

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
VERIFICATION OF AERIAL PHOTOGRAPHIC ANALYSIS OF URBAN RESIDENTIAL STRUCTURES: A STUDY OF ROCHESTER, NEW YORK, by Robert B. Monier. Jan 58, 21p. 8 refs. AFPTRC TN-58-4; AD-152 113.
Order from LC mi $2.70, ph $4.80 PB 136 710

This report describes a limited test of the applicability of a previously developed method of aerial-photo interpretation for the study of urban social data. Results for two photo interpreters indicate that this method of analysis permits successful identification of residential structures of various types and an accurate description of the structure composition of sub-areas. Although one photo interpreter was inexperienced, the percentage of error for both interpreters was insignifiaant. Methodological considerations discussed in the report include: (a) useful photo-scale ranges, (b) the effect of photo-interpretation experience, and (c) a systematic procedure for using structure combinations to predict socio-economic status. The potentials of the method are such that further study is recommended.

American Meteorological Society, Boston, Mass.
OBSERVATIONAL DATA OF THE SCIENTIFIC-RESEARCH DRIFTING STATION OF 1950-51, VOLS. I-III: VOL. II, SECT. 6, ed. by M.M. Somov, tr. by David Kraus on Contract AF 19(604) 1936. [1957] 119p. 4 refs. AD-117 137.
Order from LC mi $6.00, ph $18.30 PB 128 631

Trans. of Materialy Nablyudeniy Nauchno-issledovatel'skoy Dreyfuyushshey Stantsii 1950/51 Goda, Leningrad, 1954-55, v. 2, sect. 6.

Contents:
Ice Science
Physical-mechanical properties and thickness of the ice cover, by I.G. Petrov

Army Research Office, Washington, D.C.
ANNUAL RESEARCH TASK SUMMARY, 1959, VOLUME 5. GEOPHYSICAL SCIENCES AND ENGINEERING. 487p.
Order from OTS $4.75 PB 151 498

Columbia, U., New York.
ANALYSIS OF THE RELATIONS AMONG ELEMENTS OF CLIMATE, SURFACE PROPERTIES, AND GEOMORPHOLOGY, by Mark A. Melton. Technical rept. no. 11 on Contract N6onr-271(30). 1957, 98p. 46 refs.
Order from LC mi $5.40, ph $15.30 PB 136 843

Landform morphometry is related to causative factors of climate, mantle characteristics, vegetation density, and lithology Drainage basins analyzed are in mature fluvial development, free from obvious structural influence, and in climates ranging from arid to humid. Over 80 basins in Arizona, Colorado, New Mexico, and Utah were inspected in the field; 22 were subjected to detailed field investigations. Morphometric properties of all basins were measured from recent 1:24,000

topographic maps, or special drainage maps, and show great ranges: valley-side slope has a four-fold range, drainage density and basin relief about 100-fold, and basin area 5,000-fold. Climate was measured by the Thornthwaite precipitation-effectiveness (P-E) index, and the intensity of average five-year, one-hour rains. Lithologies distinguished are shale, clastic rocks, schist, limestone, granitic rocks, and acid volcanic rocks, assumed to indicate roughly the proportion of clay in residual soils. Mantle and cover characteristics are summarized by relative infiltration capacity, wet and dry soil strength, percentage of bare area, and surface roughness.

Iowa Engineering Experiment Station, Ames.
MILITARY TRAFFICABILITY OF SOILS IN THE MATANUSKA VALLEY, ALASKA, by H. L. Blank, D. T. Davidson and others. Progress rept. for 1 June 55-1 June 56 on Contract Nonr-530(04). Feb 57, 59p. 24 refs.
Order from LC mi $3.60, ph $9.30 PB 135 522

Most soils in the Matanuska Valley appear to provide good trafficability for most military vehicles. In this area cultivated soils provide better trafficability than adjacent virgin tracts of the same soil. All tests conducted in hay fields produced very high trafficability ratings. This study suggests a simplified procedure for tactical trafficability mapping and interpretation by military field units.

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford, Mass.
CONTRIBUTIONS TO STRATOSPHERIC METEOROLOGY, by Peter Antanaitis, Thomas R. Borden, Jr. and others. Rept. for Mar 56-Mar 58 on Stratospheric Forecasting Project. Aug 58, 16 refs. GRD Research Note no. 1; AFCRC TN-58-450; AD-152 626.
Order from OTS $2.75 PB 151 327

This note contains discussions of eight interrelated studies of stratospheric meteorology. Brief summaries of these studies are: I. Procedures for analyzing daily maps of the 100-, 50-, and 25-mb pressure level are given. Tech. for maximum utilization of the scarce data at these levels are discussed. II. A Tech. for estimating wind at 50 mb using wind and temp. gradient data at 100 mb is derived. III. Wind and temp. data for network of No. American radiosonde stations are used to obtain a climatological summary of conditions at 100, 50, and 25 mb during the 1956-57 winter. IV. Stat. properties of the wind field at 100,000 ft over No. America during Jul thru Dec 57 are tabulated and illus. by mean maps. V. North-South cross sections of temp., height, thickness, and lapse rate along 70°W are constructed to show mean annual and latitudinal variations of these parameters at 100 and 50 mb. VI. Unusually high temps, observed at 25 mb in late Jan 57 in southeastern Canada and southern Greenland, later appeared at lower levels and spread northward. These temp. anomalies and associated circulation changes are illus. by synopotic maps at the 100-, 50-, and 25-mb surfaces. VII. The variability of stratosphere winds with time is studied for mid-seasonal months for mid-latitude stations. Indications are that time variability (24-48 hrs) of stratospheric winds is much less than for tropospheric winds. VIII. Forecasts of wind at 100-, 50-, and 25-mb pressure levels based on climatology, 24-hr persistence, and prediction of "no-wind" are compared. In general, persistence forecast is superior to the climatology and "no-wind" forecasts.

Air Force Cambridge Research Center, Bedford, Mass.
THEORY OF LARGE-SCALE ATMOSPHERIC DIFFUSSION AND ITS APPLICATION TO AIR TRAJECTORIES. VOL. I, by Samuel B. Solot and Eugene M. Darling, Jr. Jun 58, 51p. 10 refs. Geophysical Research Paper No. 58; AFCRC TR-58-228 (I); AD-152 509.
Order from OTS $1.75 PB 151 448

G. I. Taylor's theory of diffusion by continuous movement is adapted to motions on the scale of the general circulation. The resultant theory pertains to diffusion, by large-ccale eddies, of air particles constrained to move on a constant-level surface. This theory provides a means for determining the probability field as a function of time for a particle originating from a given point on the surface of a sphere.

American Meteorological Society, Boston, Mass.
OBSERVATIONAL DATA OF THE SCIENTIFIC-RESEARCH DRIFTING STATION OF 1950-51, VOLS. I-III: VOL. III, SECT. 8, ed. by M. M. Somov, tr. by David Kraus on Contract AF 19(604) 1936. [1957] 235p. 3 refs. AD-117 139.
Order from LC mi $10.20, ph $36.30 PB 128 637

Trans. of Materialy Nablyudeniy Nauchno-issledovatel'skoy Dreyfuyushchey Stantsii 1950/51 Goda, Leningrad, 1954-55, v. 3, sect. 8.

Contents:

Aero-Meteorology
Meteorological observations, by K. I. Chukanin

American Meteorological Society, Boston, Mass.
OBSERVATIONAL DATA OF THE SCIENTIFIC-RESEARCH DRIFTING STATION OF 1960-51, VOLS. 1-III: VOL. III, SECT. 9, ed. M. M. Somov, tr. by David Kraus on Contract AF 19(604) 1936. [1957] 319p. 3 refs. AD-117 140.
Order from LC mi $11.10, ph $48.60 PB 128 638

Trans. of Materialy Nablyudeniy Nauchno-issledovatel'skoy Dreyfuyushchey Stantsii 1950/51 Goda, Leningrad, 1954-55, v. 3, sect. 9.

Contents:
Aero-Meteorology
Aerological observations, by E.G. Kanaki and V.E. Blagodarov
Wind observations by damper vane, by M.M. Nikitin

Cook Research Labs., Chicago, Ill.
PARACHUTE FOR ROCKET AIR LAUNCHING BASE, by Peter R. Hoffman and Richard S. Tueter. Rept. on Contract AF 33(616)3705. Jan 58, 110p. WADC Technical rept. 57-571; AD-151 021.
Order from LC mi $5.70, ph $16.80 PB 135 885

Operational and design information obtained from the various parachutes tested is intended to establish the characteristics of such parachutes to decelerate and stabilize a vehicle for launching rockets vertically upward after drop from an aircraft at high altitude. All test parachutes were designed to have an effective drag area between 100 to 120 square feet.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANALYSIS OF FREEZING PRECIPITATION ALONG THE EASTERN NORTH AMERICAN COASTLINE, by J.M. Austin and S.L. Hensel. Rept. on Contract AF 19(122)1458. 23 Mar 56, 45p. 7 refs. Technical rept. no. 112.
Order from LC mi $3.30, ph $7.80 PB 130 889

In order to provide a basis for the design of thermal anti-icing equipment for large rigid radomes, a study was conducted of freezing precipitation along the coastline of eastern North America from Thule, Greenland to Nantucket, Massachusetts. Monthly summaries of meteorological reports were utilized to select six representative stations for detailed study. Data, representing three to four years of observations from each station, was analyzed for: (1) range of precipitation rates for freezing rain and snow, and frequency and duration of such rates; and (2) wind speed and temperature regimes accompanying such rates. In addition, the geographical extent of such storms was studied. While only three or four years were covered in this survey, a comparison of this period with climatic means would indicate that the data could be used for design purposes with considerable confidence.

Massachusetts Inst. of Tech., Cambridge.
ANALYSIS OF THE IMPACTOMETER, AN INSTRUMENT FOR MEASURING THE DISTRIBUTION OF RAINDROP SIZES ENCOUNTERED IN FLIGHT, by Bronislaw Smulowicz. Master's thesis. Technical rept. no. 19 on Contract DA 36-039-sc-124. 16 May 52, 55p. 6 refs.
Order from LC mi $3.60, ph $9.30 PB 136 010

The impactometer has been designed as an airborne instrument for the measurement of the momentum of impact of raindrops on a sampling surface. From these measured values of momentum, the distribution of raindrop sizes can be easily obtained.

Massachusetts Inst. of Tech., Cambridge.
A BRIEF SURVEY OF AIRBORNE RAINDROP COLLECTION METHODS, by S.G. Millen, L. Aldaz, and D.P. Keily. Scientific rept. no. 4 on Measurement of Drop Size Distribution and Liquid Water Content in Natural Clouds. Contract AF 19(604) 1287. 15 July 57, 28p. 16 refs. AFCRC TN-58-473; AD-160 748.
Order from LC mi $2.70, ph $4.80 PB 136 031

The general requirements of an airborne instrument for counting and sizing natural raindrops in the size range 200 to 5000 microns diameter are stated. The characteristics of a variety of instruments and methods for making such counts are examined.

Massachusetts Inst. of Tech., Cambridge.
HORIZONTAL MOTION OF SMALL PRECIPITATION AREAS AS OBSERVED BY RADAR, BY Myron G. H. Ligda. Technical rept. 21 on Contract DA 36-039-sc-124. 10 Jan 53, 69p. 32 refs.
Order from LC mi $3.90, ph $10.80 PB 136 006

This study is concerned with the nature and causes of the horizontal motion of small precipitation areas which can be observed with radars. This subject is primarily of interest to synoptic meteorologists because knowledge of small precipitation area motion provides much vital information concerning upper level atmospheric currents, the motion of storm centers, and clues concerning the nature of the precipitation process.

Massachusetts Inst. of Tech., Cambridge.
INFORMATION CONTAINED IN WEATHER NOISE, PART A, by Aaron Fleisher. Technical rept. no. 22, pt. A, on Weather Radar Research, Contract DA 36-039-sc-124. 15 Jan 53, 32p. 4 refs.
Order from LC mi $3.00, ph $6.30 PB 136 011

The report is made up of the following considerations:
The problem
The general model
The restricted models
Postscripts

Massachusetts Inst. of Tech., Cambridge.
MEASUREMENT OF DROP SIZE DISTRIBUTION AND LIQUID WATER CONTENT IN NATURAL CLOUDS, by S.G. Millen and D.P. Keily. Scientific rept. no. 5 on Modifications of the Electric Probe Drop Counter for Airborne Use, Contract AF 19 (604)1287. 15 Aug 57, 49p. 11 refs. AFCRC TN-58-472.
Order from LC mi $3.30, ph $7.80 PB 136 049

Quartermaster Research and Engineering Center, Natick, Mass.
CANAL ZONE ANALOGS NO. I, ANALOGS OF CANAL ZONE CLIMATE IN MIDDLE AMERICA, by Jack V. Chambers and James M. Blaut. Apr 58,

54p. (10 color maps will not reproduce) 21 refs. Technical rept. EP-87.
Order from LC mi $3.60, ph $9.30 PB 135 950

This study compares the climate of Middle America with that of two locations in the Canal Zone: Balboa Heights, representing the drier leeward Pacific side of the Isthmus of Panama, and Cristobal, representing the wetter windward Atlantic side. Distribution of areas of analogy of pertinent climatic elements and combinations is shown in maps. The areas of close climatic analogy of combinations of climatic elements (temperature and precipitation) to the Canal Zone are generally small; even the largest area of composite analogy with Cristobal includes only the Atlantic coastal lowlands from Bluefields, Nicaragua to the Panama - Colombia border. Some individual climatic elements, however, show extensive analogy; the area with summer temperatures analogous to those of Cristobal extends throughout nearly all of Middle America and much of the United States. North of latitude 18°N and in highland areas, temperatures for the coldest month are much lower than those of either Balboa Heights or Cristobal. Annual rainfall is closely analogous to that of Balboa Heights in part of the Gulf Coast of southeastern United States, and in southern Mexico, Central America, and the Caribbean Islands. Areas as wet as Cristobal are smaller. The wettest areas are also the cloudiest. The area analogous to Cristobal with respect to relative humidity for the driest month extends, in general along the Atlantic coast, and includes the islands of the West Indies; the interior and highland areas are not sufficiently humid to be analogous to either Balboa Heights or Cristobal. The coastal plains and lowland are windiest where there are few topographic obstructions.

Quartermaster Research and Engineering Center, Natick, Mass.
CANAL ZONE ANALOGS III, ANALOGS OF CANAL ZONE CLIMATE IN EAST CENTRAL AFRICA, by Walter Beale Blair. June 58, 58p. (10 color maps will not reproduce) 26 refs. Technical rept. EP-90.
Order from LC mi $3.60, ph $9.30 PB 135 949

The climate of East Central Africa is compared with that of Balboa Heights and Cristobal in the Canal Zone. Distributions of areas of analogy of pertinent climatic elements and combinations of these elements are shown on maps. Most of the study area is too hot and too day for analogy with the tropical environment of the Canal Zone. No part of the study area has enough rainfall to be comparable with Cristobal. The one area that is closely analogous to Balboa Heights is in the Congo Basin, west of longitude 30° E and south of latitude 7°N. The amount of rainfall analogous to that of Balboa Heights is limited mostly to the southwestern part of the study area. Highlands in Kenya, Uganda, and Ethiopia are the only areas which are too cool for analogy with either Canal Zone station. Relative humidities in most of the desert and interior regions are too low for analogy. However, some areas near the Gulf of Aden, Indian Ocean, Lake Victoria, and the Congo River, are either analogous or are too high for analogy. Areas with greatest mean monthly precipitation have mean cloudiness conditions nearly analogous to the Canal Zone. Analogy of mean wind speeds with those in the Canal Zone is erratically scattered throughout East Central Africa.

Quartermaster Research and Engineering Center, Natick, Mass.
CLIMATIC ANALOGS OF FORT GREELY, ALASKA AND FORT CHURCHILL, CANADA, IN EURASIA, by Sigmund J. Falkowski, Dec 57, 75p. 48 refs. (15 color maps will not reproduce) Technical rept. EP-77.
Order from LC mi $4.50, ph $12.30 PB 135 951

Climatic conditions at Fort Greely, Alaska and Fort Churchill, Canada are compared with the climates of arctic and subarctic regions in Eurasia. The climatic elements are treated in the discussion, and maps are included to present pictorially the distribution of analogous conditions. The cold region around the "cold pole" of Siberia, in the vicinity of Verkhoyansk, is too cold for analogy to either test site. Mean temperatures for the coldest month are analogous to those of Fort Churchill in a relatively narrow band encircling this region. Coldest month temperatures analogous to those of Fort Greely, the warmer of the two test sites, are found in a second, outer band around the Siberian core region of extreme cold. Only very limited areas are found where both temperature and windchill conditions are analogous. Areas analogous to Fort Greely are confined principally to northern and eastern Novaya Zemlya and to the coastal areas bordering the southern part of the Kara Sea. Windchill and temperature conditions analogous to those of Fort Churchill during the coldest month are best defined in the northern lowlands between the Ob and Yenisey Rivers and along the Arctic coast from the Yenisey to the Lena River. Combined summer-winter temperatures and annual precipitation analogy to Fort Greely exists only in the northern part of the Central Russian Tableland and adjoining parts of the West Siberian Lowland. The northern part of the West Siberian Lowland and the Arctic Lowlands to the north receive annual precipitation amounts and have summer-winter temperatures analogous to those at Fort Churchill. Larger areas are indicated where annual precipitation combined with either summer or winter temperatures is analogous to the test sites.

Quartermaster Research and Engineering Center, Natick, Mass.
METHOD OF ASSESSING AND MAPPING THE JANUARY DAILY MINIMUM TEMPERATURES OF NORTHERN NORTH AMERICA, by Earl E. Lackey. May 58, 37p. 5 refs. Technical rept. EP-88.
Order from LC mi $3.00 ph $6.30 PB 135 948

This report presents a method of assessing and mapping the January daily minimum temperature

for northern North America (Canada north of 55°N lat., Alaska, Greenland, and Iceland). The method of assessing the frequency of daily minima requires only: (a) the mean daily minimum, (b) the absolute minimum, and (c) the length of the record. By use of these data and an adjusted probability scale, the frequency or percentage distribution of daily minimum temperatures for a station may quickly be ascertained. The adjusted probability scale was used in estimating the daily minimum probabilities for 71 stations in northern North America. Five maps constructed from the tabulated data show how the table may be used to give an overview of the whole Arctic area, featuring any selected temperature frequency. The appendix explains how the mean monthly temperature may be used to achieve the same results. However, the results are not quite as accurate.

Oceanography

American Meteorological Society, Boston, Mass.
OBSERVATIONAL DATA OF THE SCIENTIFIC-RESEARCH DRIFTING STATION OF 1950-51, VOLS. I-III: VOL. I, SECT. 1, ed. by M.M. Somov, tr. by E.R. Hope and David Kraus on Contract AF 19(604)1936. [1957] 101 p. 8 refs. AD-117 132.
Order from LC mi $5.70, ph $16.80 PB 128 636

Trans. of Materialy Nablyudeniy Nauchno-issledovatel'skoy Dreyfuyushshey Stantsii 1950/51 Goda, Leningrad, 1954-55, v. 1, sect. 1.

Contents:
The drift of the scientific research station of 1950-51, by M.M. Somov

American Meteorological Society, Boston, Mass.
OBSERVATIONAL DATA OF THE SCIENTIFIC-RESEARCH DRIFTING STATION OF 1950-51, VOLS. I-III: VOL. I, SECT. 2, by M.M. Somov, tr. by David Kraus on Contract AF 19(604)1936. [1957] 141 p. 1 ref. AD-117 133.
Order from LC mi $7.20, ph $22.80 PB 128 633

Trans. of Materialy Nablyudeniy Nauchno-issledovatel'skoy Dreyfuyushchey Stantsii 1950/51 Goda, Leningrad, 1954-55, v. 1, sect. 2.

Contents:
Oceanography
Results of a preliminary analysis of the deep-water hydrological observations, by Z.M. Gudkovich

American Meteorological Society, Boston, Mass.
OBSERVATIONAL DATA OF THE SCIENTIFIC-RESEARCH DRIFTING STATION OF 1950-51, VOLS. I-III: VOL. I, SECT. 3, ed. by M.M. Somov, Tr. by David Kraus on Contract AF 19(604)1936. [1955] 244 p. 3 refs. AD-117 134.
Order from LC mi $11.10, ph $37.80 PB 128 634

Trans. of Materialy Nablyudeniy Nauchno-issledovatel'skoy Dreyfuyushchey Stantsii 1950/51 Goda, Leningrad, 1954-55, v. 1, sect. 3.

Contents:
Oceanography
Observations of currents, by M.M. Nikitin

American Meteorological Society, Boston, Mass.
OBSERVATIONAL DATA OF THE SCIENTIFIC-RESEARCH DRIFTING STATION OF 1950-51, VOLS. I-III VOL. I, SECT 4, ed. by M.M. Somov, tr. by David Kraus on Contract AF 19(604)1936. [1957] 170 p. 2 refs. AD-117 135.
Order from LC mi $7.80, ph $25.80 PB 128 635

Trans. of Materialy Nablyudeniy Nauchno-issledovatel'skoy Dreyfuyushchey Stantsii 1950/51 Goda, Leningrad, 1954-55, v. 1, sect. 4.

Contents:
Oceanography
Hydrobiological work, by K.A. Brodskiy and M.M. Nikitin
Results of the study of bottom deposits, by N.A. Belov

American Meteorological Society, Boston, Mass.
OBSERVATIONAL DATA OF THE SCIENTIFIC-RESEARCH DRIFTING STATION OF 1950-51, VOLS. I-III: VOL. II, SECT. 5, ed by M.M. Somov, tr. by David Kraus on Contract AF 19(604)1936. [1957] [137]p. 1 ref. AD-117 136.
Order from LC mi $6.90, ph $21.30 PB 128 639

Trans. of Materialy Nablyudeniy Nauchno-issledovatel'skoy Dreyfuyushchey Stantsii 1950/51 Goda, Leningrad, 1954-55, v. 2, sect. 5.

Contents:
Ice Science
Visual observations of the state of the drifting ice cover, by G.N. Yakovlev
Study of the morphology of the ice cover by surveying, by G.N. Yakovlev

American Meteorological Society, Boston, Mass.
OBSERVATIONAL DATA OF THE SCIENTIFIC-RESEARCH DRIFTING STATION OF 1950-51, VOLS. I-III: VOL. II, SECT. 7, ed. by M.M. Somov, tr. David Kraus on Contract AF 19(604)1936. [1957] 233 p. 2 refs. AD-117 138.
Order from LC mi $10.20, ph $36.30 PB 128 632

Trans. of Materialy Nablyudeniy Nauchno-issledovatel'skoy Dreyfuyushchey Stantsii 1950/51 Goda, Leningrad, 1954-55, v. 2, sect. 7.

Contents:
Ice Science
The thermal regime of the ice cover, by G.N. Yakovlev

Chesapeake Bay Inst., Johns Hopkins U., Annapolis, Md.
BROAD CREEK CRUISE. I: 12 JULY - 14 JULY 54. II: 20 JULY - 22 JULY 54, by D.W. Pritchard. On Contracts Nonr-248(20) and Nonr-248(30). June 57, 36 p. Data rept. 29; ref. 57-4.
Order from LC mi $3.00, ph $6.30 PB 136 110

The data presented in this report were collected in the Broad Creek of the Choptank River Area during 12 July to 14 July and 20 July to 22 July 1954. The purpose of this cruise was to study the physical and chemical structure of the area.

Harvard U., Div. of Engineering and Applied Physics, Cambridge, Mass.
EDGE WAVES OVER A DISCONTINUOUS OCEAN BOTTOM: STEADY STATE CASE, by Richard M. Durstine. Rept. on Contract Nonr-1866(20). July 57, 19 p.
Order from LC mi $2.40, ph $3.30 PB 135 973

Washington U., Seattle.
POLAROGRAPHIC DETERMINATION OF NITRATE IN SEA WATER, by Tung-whei Chow and Rex J. Robinson. Technical rept. no. 12 on Contract N8onr-520(03). Aug 52. 23p. 12 refs. Ref. no. 52-5; AD-507.
Order from LC mi $2.70, ph $4.80 PB 136 406

This investigation was undertaken to develop a new, rapid and accurate method for the determination of nitrate in sea water, based upon the polarographic reduction of nitrate in the presence of uranyl ions.

Physics of the Atmosphere

Dugway Proving Ground, Utah.
ATMOSPHERIC HEAT TRANSFER PROBLEM WITH EDDY DIFFUSIVITY VARYING AS A POWER LAW WITH HEIGHT, by Harvey Greenfield. Oct 57, 91 p. 12 refs. Technical rept. DPGR 200.
Order from LC mi $5.40, ph $15.30 PB 136 104

A convective heat flow solution is presented for prediction of temperature in the lower layers of the atmosphere. Boundary temperature at the soil-air interface is taken to vary sinusoidally with time while eddy diffusivity varies sinusoidally with time and as a power law with height. Characteristic values for sample terrain were obtained from an electronic computer for powers from 0 to 2 from 1 to 20 meters.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta
STUDY OF THE SOLUBILITY AND RATE OF SOLUTION OF FINE AEROSOL PARTICLES, by Clyde Orr, Jr., F. Kenneth Hurd, and Warren P. Hendrix. Scientific rept. no. 1 on Contract AF 19(604)1970. Feb 58, 53p. 4 refs. AFCRC TN-58-264; AD-152 506.
Order from OTS $1.50 PB 131 996

Investigations were made of the rates at which small particles (20 to 0.03 μ radius) of rather soluble materials such as NaCl re-establish equilibrium after sudden shifts in relative humidity. Largest-particle rates were determined photographically; changing times for the smallest sizes could not be measured with an ion counter as originally hoped, but were finally deduced from light scattering records.

ENGINEERING

Naval Research Lab., Washington, D.C.
EFFECT UPON SHOCK SPECTRA OF THE DYNAMIC REACTION OF STRUCTURES, by George J. O'Hara. 16 Dec 58, 21 p. 12 refs. NRL rept. 5236.
Order from LC mi $2.70, ph $4.80 PB 135 645

Attempts to use fiducial limit curves of a set of classes of shock spectra as a basis for the design of structures have shown that the design spectra obtained by the combinatorial analysis of many shock spectra tend to be overconservative. This interim report presents a possible explanation for this. It exhibits some experimental evidence to show that the values of interest in a shock spectrum plot tend to lie in the valleys of that plot and not upon the peaks, whereas fiducial limit curves are controlled by the peaks of the individual shock spectra.

Aeronautical Engineering

Advisory Group for Aeronautical Research and Development, Paris (France).
ALL-WEATHER TESTING IN THE UNITED STATES AIR FORCE, by Louis G. Gamble. Apr 58, 12p.
Order from NASA* AGARD-200

Presented at the Flight Test Panel Meeting, held from 21st to 25th April, 1958, in Paris.

The procedure adopted for the all-weather testing of airplanes of the United States Air Force, known as 'Phase V Testing' is described. The tests are divided into two parts: (a) Extreme temperature testing; (b) The weather flight phase. In the first phase - extreme temperature testing - tests are carried out at various temperatures ranging from about -65°F to as high as 160°F in certain cases. In the second phase, the airplane is tested in the worst weather conditions that can be found, and the tests include hooded and night flying. Considerable emphasis is laid on icing tests.
* National Aeronautics and Space Administration, 1520 H Street, N.W., Washington 25, D.C.

Aircraft Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
SPIN AND RECOVERY TEST OF A 1/20-SCALE MODEL OF THE CESSNA XT-37 AIRPLANE, by Wilhelm F. Knackstedt and John J. Sury. Rept. for Apr - Oct 54 on Intermediate Jet Trainer System T-37. Sep 57, 44p. 3 refs. WADC Technical rept. 57-584; AD-131 083.
Order from LC mi $3.30, ph $7.80 PB 135 884

Two 1/20-scale models of the Cessna XT-37 airplane were investigated for spin and spin recovery characteristics in a 12-ft vertical wind tunnel for various load conditions and at simulated altitutdes of 19,000 and 27,500 fet. In the lighter load conditions the flaps and speed brakes have a favorable effect for recovery, while in the heavier load conditions they have an adverse effect in several control configurations. The airplane will recover from a spin within 1 1/2 turns with light load by reversing the rudder only, and for heavier loads by simultaneous reversal of rudder and elevator. The elevator should be full up before spin recovery is attempted for fastest recoveries with light loads. Recovery from inverted spins may be accomplished by rudder against the spin with simultaneous rapid movement of elevator from full down to full up. There are several control configurations from which satisfactory recoveries can be accomplished in all load conditions. Generally the model assumes a vertical rolling dive after recovery attempt. It is considered possible to recover from the vertical rolling dive by normal control manipulation.

Aircraft Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
UPWARD EJECTION GROUND AND FLIGHT TESTS OF AIRCRAFT PERSONNEL CATAPULT TYPE T-5, by K.F. Hecht. Dec 53, 59p. 2 refs. WADC Technical rept. 53-363; AD-62 686.
Order from LC mi $3.60, ph $9.30 PB 136 128

The ejection tests of a seat and dummy combination utilizing a type T-5 Aircraft Personnel Catapult are described in four phases: ground tests, flight tests with the F-82B aircraft, flight tests with T-33A aircraft, and flight tests with the B-47A aircraft. These tests were conducted at Wright-Patterson Air Force Base and Clinton County Air Force Base between the dates of 5 December 1949 and 10 June 1953, for the purpose of studying the ejection characteristics of B-47 and XB-52 seats equipped with the T-5 Aircraft Personnel Catapult. The test results are presented and the conclusion is drawn that the ejection seat, equipped with the T-5 catapult, is adequate for escape from the B-47 and XB-52 aircraft.

Aircraft Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
UPWARD EJECTION SEAT FLIGHT TESTS UTILIZING THE M4 CAPTAPULT, by K.F. Hecht. Dec 53, 34p. 3 refs. WADC Technical rept. 53-364; AD-63 454.
Order from LC mi $3.00, ph $6.30 PB 136 125

The test series performed on the M4 Aircraft Personnel Catapult was conducted at Wright-Patterson Air Force Base, Ohio, between 4 May 1953 and 17 December 1953. These tests were used to determine the suitability of the M4 catapult in the upward ejection of a light weight seat, instead of in downward ejection, for which it was designed. Test results are presented and the conclusion is drawn that the M4 Aircraft Personnel Catapult provides adequate tail clearance in upward ejections of light weight seats at speeds up to 347 knots in aircraft with the approximate configuration of that utilized.

Battelle Memorial Inst., Columbus, Ohio.
THE MECHANICAL PROPERTIES OF CERTAIN AIRCRAFT STRUCTURAL METALS AT VERY LOW TEMPERATURES, by Robert L. McGee, James E. Campbell and others. Rept. for 20 Mar 56-15 July 57, on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3542. Nov 58, 63p. WADC Technical rept. 58-386; AD-204 422.
Order from OTS $1.75 PB 151 459

New aircraft developments have required the use of structural metals at very low temperatures. In this investigation, tensile and hardness properties of nine alloys of interest to the aircraft industry were determined at four temperatures from room temperature to -253 C (in liquid hydrogen). These alloys were 17-7PH and AM-350 stainless steels, AISI 4340 and Tricent steels, 7079-T-6 aluminum and ZK60A-T5 magnesium alloys, and A110AT, C110M, and 6Al-4V titanium alloys. Notched impact energies were determined on the two steels and the aluminum and magnesium alloys at the low temperatures. Values for hardness, elastic modulus, yield strength, and tensile strength of these materials tended to increase as the temperature was reduced to -253C. However, only the 17-7PH stainless steel, the aluminum and magnesium alloys, and the A110AT and 6Al-4V titanium alloys reached 0.2 per cent offset for yield-strength determination at -253 C before fracturing. Of these, the titanium alloys had much higher yield strength-density ratios than the other alloys at the low temperatures. Tensile and impact tests on notched bars showed the tendency for embrittlement of the nine alloys at low temperatures.

Beech Aircraft Corp., Wichita, Kans.
STUDY OF SIMPLIFIED METHODS OF AIRFOIL HEATING, by T. Richard Barksdale, Julio N. Erazo, and Robert L. Fischer. Rept. on Contract AF 33(616)2874. June 58, 82p. 10 refs. WADC Technical rept. 57-587; AD-203 522.
Order from OTS $2.25 PB 151 479

A simplified method of thermal anti-icing was investigated to obtain data which would permit aircraft designers to evaluate the method for practical application. The simplified method utilizes heated air such as that available from the compressor section of a turbo-jet engine. Internal heat transfer coefficients were determined for several configurations and with airflows covering the expected range

of interest. Relationships are developed to predict the internal air temperature from over-all energy balance.

Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
ADDITIONAL FLIGHT EVALUATIONS OF VARIOUS LONGITUDINAL HANDLING QUALITIES IN A VARIABLE-STABILITY JET FIGHTER, by Charles R. Chalk. Rept. on Contract AF 33(616) 3990. Jan 58, 55p. 9 refs. WADC Technical rept. 57-719, pt. 1; AD-142 184.
Order from OTS $1.50 PB 151 456

An F-94 jet fighter has been modified by the Cornell Aeronautical Laboratory to provide variable longitudinal stability and control characteristics thus permitting in-flight variations of the longitudinal handling qualities. Evaluations were conducted in flight by two pilots of a variety of short period dynamics, stick force gradients, and stick displacement gradients. The qualitative ratings of longitudinal handling qualities are shown as areas of varying degrees of the pilot's acceptance of these characteristics. The pilot comments are discussed and related to the short period dynamics and the stick force and motion gradients.

Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
ADDITIONAL FLIGHT EVALUATIONS OF VARIOUS LONGITUDINAL HANDLING QUALITIES IN A VARIABLE-STABILITY JET FIGHTER, by Charles R. Chalk. Rept. on Contract AF 33(616) 3990. July 58, 34p. 8 refs. WADC Technical rept. 57-719, pt. 2; AD-206 071.
Order from OTS $1.00 PB 151 457

An F-94 jet fighter has been modified by the Cornell Aeronautical Laboratory to provide variable longitudinal stability and control characteristics, thus permitting in-flight variations of longitudinal handling qualities. Evaluations have been conducted in flight by three pilots of a variety of short period dynamics, stick force gradients, and stick displacement gradients. Part I of this report present sented the results of the first two pilot evaluations. Part II presents the results of evaluations by a third pilot and summarizes the results of the evaluation by all three pilots. Part II also presents results of flight evaluations conducted to determine "minimum flyable" longitudinal handling qualities. Recommendations are suggested for revision of MIL-F-8785 (ASG) Section 3.3.5, Short Period Oscillations.

Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
INVESTIGATION OF THE COMPRESSIVE, BEARING AND SHEAR CREEP-RUPTURE PROPERTIES OF AIRCRAFT STRUCTURAL METALS AND JOINTS AT ELEVATED TEMPERATURES, by Luke A. Yerkovich. Rept. for Mar 56 - May 57 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3456. May 58, 96p. 5 refs. WADC Technical rept. 54-270, pt. 4; AD-155 570.
Order from OTS $2.50 PB 151 445

The establishment of the high-temperature mechanical properties of aircraft constructional materials is a prerequisite to efficient design when elevated temperature service is expected. These properties, which normally are determined from the conventional short-time tensile test and the tensile-creep test, are not necessarily applicable if stress conditions other than tension are encountered. The present program was initiated to examine the high-temperature strength characteristics of a number of aircraft structural alloys when subjected to a variety of stresses under both short and long time loading with the specific purpose of applying these high-temperature characteristics to riveted joint configurations. This report summarizes in tabular form the high-temperature short-time strength properties of a number of test alloys in tension, compression, bearing, and shear. Data representing the bearing creep behavior of 2024-T3 aluminum alloy sheet for a number of variables associated with bearing are also included. The creep behavior of several selected joint designs undergoing bearing and shear creep are illustrated as time-deformation charts, and comparisons between the predicted and experimental performances are made.

Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
A STUDY OF EXPERIMENTAL TECHNIQUES FOR THE MEASUREMENT OF STATIC AND DYNAMIC TIRE PARAMETERS RELATED TO NOSEGEAR SHIMMY, by Albert G. Fonda. Rept. on Development of a Technique for Measurement of Tire Parameters, Contract AF 33(616)3540. Aug 57, 66p. 3 refs. WADC Technical rept. 57-390; AD-155 798.
Order from OTS $1.75 PB 151 254

Experimental methods are described and empirical results are presented for tests performed upon two types of aircraft tire. Measurements of static compliance, lateral load shift, yawed-rolling compliance, and circumferential creep due to braking were made on 20 x 4.4 - 10 ply Type VII Aircraft Tires at various inflation pressures and vertical loads. Lateral and yawed-rolling compliance tests were performed on a 26 x 6.6 - 12 ply Type VII Aircraft Tire at 120 psi inflation and 1860 pound vertical load. In addition, proposed test methods and fabricated equipment are described for tests of the dynamic tire force and moment response to oscillating steer angle, and the force-moment response for co-rotating duals.

Directorate of Flight and All-Weather Testing, Wright-Patterson AFB, Ohio.
FLIGHT TEST RESULTS OF THE GOODRICH HIGH PRESSURE PNEUMATIC DE-ICERS, by Ollie D. Miller. July 54, 44p. 5 refs. Technical note WCT-54-48; AD-38 950.
Order from LC mi $3.70, ph $7.80 PB 136 203

The ice removing ability of the Goodrich high-pressure pneumatic deicing boots was evaluated, and determinations were made of the losses in aircraft performance and changes in stability and

control that can be directly attributed to the operation of the boots in dry air and an icing conditions. Speed power data in dry air were obtained at 5-, 10-, and 15, 000-ft pressure altitude. Flights were made in natural icing conditions of various intensities from 5- to 10, 000-ft altitudes and from 200 to 275 knots. Photographs of the boots surfaces were obtained during the icing encouters before, during and after the deicing system was put into operation. Values of the suction and pressure of the air utilized for the operation of the boots were recorded during each flight. The effect of the boots on level-flight aircraft performance appeared to be relatively independent of altitude. At least 80% engine rpm is required to provide the desired 22 psig pressure for the system at an altitude of 5000 ft. The required rpm becomes greater as altitude is increased, becoming 90% at 20, 000 ft. The system performed satisfactorily at pressures below 22 psig. The Goodrich high-pressure pneumatic deicing system, as installed on aircraft F-94C no 50-963, provides satisfactory protection against the icing and flight conditions as specified in A/N Spec. no. 40395-C.

Eastern Research Group., Brooklyn, N.Y.
REVERSE THRUST, VERTICAL LIFT, AND JET SIDE FORCE BY MEANS OF CONTROLLED JET-DEFLECTION, by Leonard Meyerhoff and Stanley Meyerhoff. Rept. on Contract AF 18(600)1530. Jan 56, 53p. 24 refs. AFOSR TN-56-168; AD-86 589.
Order from LC mi $3.60, ph $9.30 PB 134 545

An important aviation development is reverse thrust produced by deflecting the jet almost 180° forward in order to brake thelanding run. Reverse thrusts up to 90% of rated positive thrust have been measured at zero airspeed. For jet-braking at high speeds, the analysis predicts several hundred percent reverse thrust. Various consequences of these values are investigated.

General Electric Co., Schenectady, N.Y.
CURRENT STATUS OF KNOWLEDGE ON DESIGN CRITERIA FOR BEARINGS USED IN HIGH TEMPERATURE AIRCRAFT ELECTRICAL ACCESSORIES, by P. Lewis, S.F. Murray, and A.A. Schwartz. Phase 1 on Development of Design Criteria for Bearing Used in High Temperature Aircraft Electrical Accessories, Contract AF 33(616) 5766. Sep 58, 58p. 40 refs. WADC Technical rept. 58-519; AD-203 792.
Order from OTS $1.50 PB 151 519

The current state of knowledge of Bearing Development for Aircraft Electrical Accessories was determined by contact with bearing, lubricant, and accessory manufacturers. This information is supplemented by pertinent data from investigations performed in the General Electric Co. This report is preliminary to an investigation for the Development of Design Criteria for Bearings Used in High Temperature Aircraft Electrical Accessories. The goal of the investigation is a bearing system capable of operation at 700 F. The problem resolves itself into the proper choice of materials, lubricants, bearing design, and a system which will utilize these successfully. Many materials have shown promise for this temperature range; the M series tool steels appear to be most desirable based upon the requirements of this program. The fluids under consideration fall into the following groups: silicones, silicate esters, silanes, mineral oils, polyphenyls and polyphenyl ethers, fluorinated organic compounds, esters, and polyolefins. These represent a wide range of physical properties which will be utilized in accordance with the choice of a system. Fluids which burn off clean might be more applicable to a "once through" system than a more stable fluid which forms a jamming residue. In the bearing design, loose clearances, open curvatures, and land riding cages seem most desirable. M-50 tool steel bearings containing "S" Monel or Ni Resist Cages show promise for successful performance. Two systems appear to have the most promise: grease packed bearings and a modified "once through" system.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A REVIEW OF THE AIR FORCE MATERIALS RESEARCH AND DEVELOPMENT PROGRAM, by Helen Hines Maxwell. Rept. for 1 July 57-30 June 58. Dec 58, 217 p. 303 refs. Supplement 5 to WADC Technical rept. 53-373; AD-206 861.
Order from OTS $3.50 PB 111 648(Sup. 4)

Three hundred and three (303) technical reports and technical notes written during the period 1 July 1957-30 June 1958 are abstracted herein. These reports cover the following areas of research: Adhesives, biochemistry, electronic materials, materials physics, metallurgy, packaging, petroleum products, plastics, protective treatments, rubber and textiles. A contractor index, investigator index and a numerical index of all the technical reports and technical notes issued during the period March 1923 - 1958 are provided.

National Advisory Committee for Aeronautics, Washington, D.C.
DITCHING INVESTIGATIONS OF DYNAMIC MODELS AND EFFECTS OF DESIGN PARAMETERS ON DITCHING CHARACTERISTICS, by Lloyd J. Fisher and Edward L. Hoffman. 1958, 30p. 2 refs. Supersedes TN 3946; AD-121 219.
Order from GPO $0.50 NACA rept. 1347

Data from ditching investigations conducted at the Langley Aeronautical Laboratory with dynamic scale models of various airplanes are presented in the form of tables. The effects of design parameters on the ditching characteristics of airplanes, based on scale-model investigations and on reports of full-scale ditchings, are discussed. Various ditching aids are also discussed as a means of improving ditching behavior.

National Advisory Committee for Aeronautics, Washington, D.C.
EXPERIMENTAL EVALUATION OF LOW-BAND-PASS LANDING-GEAR SHOCK ABSORBER FOR PULSE LOADINGS, by Emanuel Schnitzer. Sep 58, 39p. 3 refs.
Order from NASA* NACA TN-4387

An experimental evaluation of the load-reducing capabilities of the low-band-pass shock strut was made by comparison with a fixed-orifice shock strut. An experimental low-band-pass strut was constructed and equipped with a high-pressure wheel and tire. Taxi runs were made over single and multiple bumps to determine strut pulse rate response and recycling characteristics. Comparisons for single rapidly applied pulses showed low-pass loads to be 50 percent of the fixed-orifice strut load and less than 25 percent of the fixed-orifice strut loads for repeated bumps. Smaller reductions were shown for rapidly applied pulses superposed on slowly applied pulses during landings on bumps. A low-pass vibration absorber is also described.

North American Aviation, Inc., Los Angeles, Calif.
CYCLIC CREEP BUCKLING OF INTEGRALLY STIFFENED ALUMINUM ALLOY PANELS, by C.W. King and B.J. Nolan. Rept. for 15 Mar 56-15 Mar 58 on Structural Design Criteria, Contract AF 33 (616)3369. Apr 58, 124p. 26 refs. WADC Technical rept. 58-38; AD-155 834.
Order from OTS $2.75 PB 151 515

An effort has been made to determine the applicability of the hypothesis of cumulative damage to intermittent cycles of creep loading on the aluminum alloys 2024-T4 and 7075-T6. A comparison is made on creep buckling lifetimes for intermittent loading tests with continuous load tests for creep buckling specimens; and a similar comparison is made for tension creep specimens with the master rupture parameter, T_R $(C + \log_{10} t)$. Seven buckling specimens were tested under specimens loadings in an evaluation of creep under multiple stress levels. The buckling specimens consisted of identical upper and lower sculptured skin panels mounted as tension and compression surfaces, respectively, of an open-sided box beam loaded with equal end moments. The tension specimens, which were simultaneously tested with the buckling specimens under identical stress, cyclic, and environmental conditions, were standard ASTM-recommended tension coupons. Intermittent cycles were applied by load and temperature cycling, temperature cycling, or load cycling only. Temperatures of 350°F and 400°F were used for the 2024-T4 intermittent tests, and 250°F and 300°F for the 7075-T6 intermittent tests. Test results indicate poor correlation of cumulative time-to-failure to uninterrupted time-to-failure for buckling tests, and also for tension tests where comparisons are made by use of the master rupture parameter. In general, the cyclic creep buckling tests resulted in lower lifetimes than equal environment continuous type tests.

Propeller Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
PROPELLER PERFORMANCE AT ZERO FORWARD SPEED, by Dana A. Webb and Jack E. Willer. July 52, 78p. 11 refs. WADC Technical rept. 52-152; ATI-188 208.
Order from LC mi $4.50, ph $12.30 PB 135 596

Static thrust data from propeller whirl tests at Wright-Patterson Air Force Base, and several other sources, on numerous propellers are analyzed and correction factors are derived which correlate these data. Standard curves for static thrust are for 2, 3, and 4-bladed single rotation propellers, and for 6 and 8-bladed dual-rotation propellers. These standard curves, together with the correction factors, are used to predict the static shaft thrust of any conventional propeller to within about 5%. With the exception of a two-bladed Clark-Y propeller curve, all standard curves are for propellers utilizing NACA 16-series airfoil sections.

Propulsion Lab., Wright Air Development Center, Wright-patterson AFB, Ohio.
DEVELOPMENT OF A PROPELLER AERODYNAMIC STRIP ANALYSIS EMPLOYING AN ITERATIVE INDUCED INFLOW TREATMENT FOR SOLUTION ON A HIGH SPEED DIGITAL COMPUTER, by James P. Cooper and Stanley E. Tate. Sep 57, 26p. 4 refs. WADC TR-57-527; AD-130 997.
Order from LC mi $2.70, ph $4.80 PB 135 887

This report describes a Propeller Aerodynamic Strip Analysis developed by the Propulsion Laboratory, Wright Air Development Center to utilize the Remington-Rand, Univac Scientific 1103 Digital Computer. The analysis employs Theodorsen's extension of Goldstein's theory as the basis for a rapidly convergent iteration process in determining the propeller induced inflow. Performance problems for single rotation propellers including normal, chordwise, and side force calculations for the yawed propeller condition may be computed by this method.

Propulsion Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DEVELOPMENT OF A PROPELLER BLADE TORSIONAL DEFLECTION ANALYSIS FOR SOLUTION ON A HIGH SPEED DIGITAL COMPUTER, by James P. Cooper. Sep 57, 47p. 8 refs. WADC Technical rept. 57-528; AD-130 998.
Order from LC mi $3.30, ph $7.80 PB 135 886

This report presents a method for determination of propeller blade torsional deflection based on relations derived for thin, solid, pretwisted propeller blade segments and programmed for solution on a high speed digital computer. This method is then employed in a combination propeller strip and blade

* National Aeronautics and Space Administration, 1520 H Street, N.W., Washington 25, D.C.

torsional deflection analysis. "Generalized" aerodynamic pitching moment coefficient data is developed for use in this combination for an iterative solution to accurately determine the aerodynamic moment, blade torsional deflection, and propeller performance with the resulting "live" twist.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
AUTOMATIC CORRECTION OF ERRORS IN AIRPLANE STATIC PRESSURE SOURCES, by Frank D. Werner and Robert L. Geronime. Rept. on Contract AF 33(600)27224. May 56, 95p. 13 refs. WADC Technical rept. 56-193; AD-144 587.
Order from LC mi $5.40, ph $15.30 PB 137 158

The problem of automatic correction of errors in airplane static pressure sources is reviewed in detail, and two models of the device called the static pressure compensator which accomplishes this correction are described. Included is a brief discussion of the aerodynamic considerations involved in static pressure errors and of the choice of variables in terms of which the static pressure errors may be presented.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
THE HIGH TEMPERATURE HEATER AND EVAPORATIVE FILM COOLING OF NOZZLE THROAT SECTIONS OF THE ROSEMOUNT AERONAUTICAL LABORATORIES' HYPERSONIC FACILITY, by Rudolf Hermann, Hans Leitinger, and Walter L. Melnik. Rept. on Contract AF 33(616)473. July 58, 59p. 14 refs. WADC Technical rept. 58-376; AD-204 663.
Order from OTS $1.50 PB 151 487

A gasfired storage heater to heat the supply air for the 12 inch x 12 inch hypersonic wind tunnel at Rosemount Aeronautical Laboratories was designed, manufactured, and installed. Preliminary firing tests have been conducted with this heater. An experimental investigation on evaporative file cooling of hypersonic nozzle throat sections was conducted in the 12 inch x 12 inch hypersonic wind tunnel of the Rosemount Aeronautical Laboratories. Coolant (water) was injected through a thin strip of porous metal located upstream of the throat where the average Mach number was 0.08. The object of this investigation was to determine the influence of evaporative film cooling on the nozzle flow. Two configurations have been investigated with 15^{o} and 30^{o} expansion angle.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
EVALUATION OF CLOSED-CIRCUIT STANDARD TELEVISION FOR ARTC SECTOR COORDINATION, by Russell M. Andrew, Thomas S. Wonnell, and Fred S. McKnight. Oct 58, 8p. Technical Development Rept. no. 307.
Order from OTS $0.50 PB 151 288

This report describes evaluation tests of an industrial type closed-circuit standard television system for data transfer and controller coordination in the Indianapolis Air Route Traffic Control Center. The equipment permitted a controller at one sector to view fix-posting strips for an adjacent fix which were posted on a sector board located across the control room. A maximum of five strips in one bay could be read at one time. Because of limitation in system resolution and sensitivity, the equipment was not satisfactory for traffic-control purposes.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
EVALUATION OF THE DUMONT SRD-1 BRIGHT RADAR DISPLAY AND INITIAL STUDY OF OTHER DISPLAY TECHNIQUES, by William E. Miller, Marvin H. Yost, and David S. Crippen. Oct 58, 19p. 13 refs. Technical Development rept. no. 288.
Order from OTS $0.75 PB 151 289

The DuMont SRD-1 bright radar display uses a Graphechon storage tube for scan conversion and storage purposes. Radar information in polar-scan form is converted into a television-type rectilinear scan to provide video and synchronizing output signals to drive two 12-inch indicators and one 30-inch indicator which were furnished as part of the equipment. Bright-phosphor cathode-ray tubes are used in the indicators to obtain bright displays. Because bright-phosphor tubes have low persistence, the storage capabilities of the Graphechon tube are used to add storage or persistence to the final display. The storage time can be adjusted to permit storage of targets for several antenna scans as desired. The video and synchronizing output signals also may be used to drive other television-type indicators, including television projection systems for large displays, and they may be remoted to distant points by available broadband relay systems. Results of the evaluation indicated that the brightness of the display is satisfactory for use under high ambient light levels. In spite of its complexity and bulk, the equipment stability was satisfactory in most respects during long periods of operation. The resolution of the final display was less than that of a normal plan position indicator using a cathode-ray tube with a P7 phosphor. Likewise, its ability to display readable signals in noise was not as good as might be expected from the normal radar plan position indicator. Results of the initial studies on other display techniques indicate that future efforts should be directed toward the development and evaluation of direct-view storage tubes, dark-trace tubes, and rapid photographic projection systems.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
IMPACT TESTS OF FULL-TEMPERED GLASS WINDSHIELD PANELS, by Pell Kangas. Oct 58, 6p. 1 ref. Technical Development rept. no. 71.
Order from OTS $0.50 PB 151 347

This report presents the results of impact and optical deviation tests carried out upon full-tempered glass panels of 1/4-inch, 1/2-inch, 3/4-inch, 1-inch, and 1 1/4-inch thicknesses nominally 12 inches by 36 inches in size. An exponential relationship exists between the penetration velocity and the panel thickness. At impact velocities less than the that required for failure, no effect upon the full-tempered pane was observed. At impact velocities which result in panel failure, the energy-absorption factor of the full-tempered glass was indicated to be relatively low. The penetration velocity of these panels is independent of panel temperature. The full-tempered glass panes showed excellent optical characteristics. From weight consideration, the practical application of full-tempered glass panels for aircraft use appears to be limited to low-speed aircraft, windshield installations with a high angle of panel slope, and particularly for side- or corner-window installations of high slope.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
A STUDY OF IGNITION HAZARDS AND FIRE-RESISTANCE OF THE BOEING 707 POWERPLANT, by Allen V. Young. Aug 58, 21p. 1 ref. Technical Development rept. no. 357.
Order from OTS $0.50 PB 151 328

A study was made of the characteristics of powerplant fires in the Boeing 707 pod-type turbojet engine installation and of the ignition hazards and fire-resistance characteristics of this installation. The powerplant under investigation employed a tightly sealed nacelle with a low rate of ventilation. The early phases of this study indicated that the flammable fluids used in the powerplant would not ignite from contact with the hot surfaces of the engine under normal operating and nacelle airflow conditions. However, the particular type of fuel-air starter employed in this test article would ignite JP-4 fuel and MIL-O-5606 hydraulic fluid readily when either was sprayed on the starter during the starting cycle. In order to study external flame paths, a prolonged uncontrolled in-flight fire was simulated. It was observed that the strut dimensions for this design were adequate to prevent flame impingement on the wing although considerable damage was done to the nacelle doors with lesser damage to the strut skin. An uncontrolled powerplant fire of the size and intensity used in these tests should not damage any portion of the wing.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
TESTS OF THRESHOLD LIGHTING PATTERNS, by H.J. Cory Pearson. Nov 58, 5p. 2 refs. Technical Development rept. no. 276.
Order from OTS $0.50 PB 151 326

This report describes the testing of a number of patterns of threshold lighting for the purpose of developing a pattern which will be more effective than the existing Air Force standard. A number of arrangements and modifications were tried, most of which showed some improvement over the existing standard. One pattern was evolved which incorporates the most effective improvements.

Chemical Engineering

Army Research Office, Washington, D.C.
ANNUAL RESEARCH TASK SUMMARY, 1959. VOLUME 6. MATERIALS TECHNOLOGIES. 274p.
Order from OTS $2.75 PB 151 499

California U., Berkeley.
PARTICLE SIZE DISTRIBUTION MEASUREMENT WITH ELECTRON INSTRUMENTATION BASED UPON LIGHT SCATTERING, by Chester T. O'Konski. Technical rept. no. 3 on Contract [Nonr]222 (12). Sep 56, 71p. 46 refs.
Order from LC mi $4.50, ph $12.30 PB 129 341

A study has been made of the applicability of light scattering to the determination of concentrations and size distributions in systems of spherical particles by combination of photometric and pulse analyzing instrumentation. The results indicate that rapid measurements of a high degree of accuracy and reproducibility are possible with the use of the described instrumentation and methods. Relative scattering intensities for seven sizes of uniform latex aerosol particles in the range 0.333 to 1.17 μ diameter are reported. A brief resumé of previous work in this field is given, and the principal experimental considerations involved in the determination of size distribution spectra are discussed. Possible adaptations of the instrument are indicated.

General Mills, Inc., Minneapolis, Minn.
PARTICLE SIZE TECHNOLOGY: SURVEY OF TECHNICAL LITERATURE, by E.N. Kemler, M.H. LaJoy, and E.N. Kemler, Jr. Sep 53, 158p. 700 refs. Rept. no. 1233.
Order from LC mi $7.50, ph $24.30 PB 135 385

Massachusetts Inst. of Tech., Cambridge.
CONSIDERATIONS IN THE DESIGN OF GAS MASK OUTLET VALVES, by Donald P. Smith. Oct 45, declassified 13 Mar 54. 93p. MIT-MR nr. 212.
Order from LC mi $5.40, ph $15.30 PB 135 136

Descriptions of standardized U.S. gas mask outlet valve, foreign valves which represent various valve types, and experimental outlet valves are collected in this report. Photographs or sketches of most of these valves are also included. A discussion of considerations in outlet valve design is presented and includes required characteristics, test apparatus, methods of evaluation of sample valves, a table of desirable production limits, and a suggested procedure for development of gas mask outlet valves.

Massachusetts Inst. of Tech., Cambridge.
SOME ASPECTS OF THE STABILIZATION OF CONCENTRATED SOLUTIONS OF HYDROGEN PEROXIDE, by W.C. Schumb. Rept. no. 50 on Contract Nonr-1841(11). Feb 57, 18p. 3 refs.
Order from OTS $0.50 PB 151 015

The status of present-day practices in the production and stabilization of hydrogen peroxide has recently been reported by W.C. Schumb, C.N. Satterfield, and R.L. Wentworth (Hydrogen peroxide, ACS Monograph no. 128, Reinhold Pub. Corp., New York, 1955). The present paper gives further consideration to the subject of stabilization of concentrated solutions of hydrogen peroxide, with special attention to certain aspects of the use of sodium stannate in long-term storage of hydrogen peroxide in aluminum containers. Experimental data are presented showing the dexomposition rates of 90% H_2O_2 solution at 50°C, as received or redistilled; and after addition of known concentrations of stannate or pyrophosphate ions, or both. Further data are included on the effect of concentration upon stability.

Naval Research Lab., Washington, D.C.
CHEMICAL-RESISTANT SILK SCREEN INKS FOR THE MANUFACTURE OF PRINTED CIRCUITS, by G.E. Rohl, W.H. Stewart and others. Final rept. 8 Jan 59, 41p. 12 refs. NRL rept. no. 5245.
Order from OTS $1.25 PB 151 248

This Laboratory, in studying silk screen ink at the request of the U.S. Naval Avionics Facility, has shown that the quality of printed circuits produced from the silk screen process depends in large measure upon the quality of the screen and the subsequent etching process. Good adhesion, toughness, and chemical inertness of the ink are important and desirable properties, but the quality of the screen with the circuit design applied to it, and the method of etching seem to have much more influence on the quality of resulting printed circuits than the chemical and physical characteristics of the ink. Four formulations were developed which provide silk screen inks of different characteristics to meet variable production requirements. In general, one ink, which is based on a vinyl resin, affords the best overall balance of screenability with essential physical and chemical properties. In addition, this report discusses the methods and materials of silk screen and printed circuit manufacture found most efficient by NRL.

Office of Scientific Research and Development. Div. 10.
APPARATUS AND METHOD FOR DETERMINING GAS MASK OUTLET VALVE LEAKAGE UNDER CONDITIONS OF USE, by D.P. Smith and J.W. Zabor. (Northwestern Technological Inst.). Progress rept. to 12 Oct 43 on Contract OEMsr-282. 4 Nov 43, declassified 5 Nov 53, 7p. OSRD-1984; ATI-32909.
Order from LC mi $1.80, ph $1.80 PB 136 289

Power Plant Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
METHOD FOR ELIMINATING THE EFFECTS OF RESIDUAL NITRIC ACID IN ROCKET ENGINES AND RELATED EQUIPMENT, by Edward L. Harris. Dec 56, 11p. WADC Technical rept. 57-31; AD-110 732.
Order from LC mi $2.40, ph $3.30 PB 136 175

Residual nitric acid and nitrogen dioxide remaining after firing of a rocket engine causes severe corrosive action.

Civil Engineering

Naval Civil Engineering Research and Evaluation Lab., Port Hueneme, Calif.
SKYLIGHTING PATTERNS FOR DAYLIGHT ILLUMINATION OF THE BUREAU STANDARD RIGID FRAME STEEL BUILDING, 40 FT BY 100 FT AND THE BUREAU STANDARD ARCH RIB STEEL BUILDING 40 FT BY 100 FT, by P. J. Rush. 23 Mar 54, 33p. Technical note N-184.
Order from LC mi $3.00, ph $6.30 PB 135 914

A program leading to the selection of skylighting systems for the daylight illumination of the Bureau Rigid Frame Steel Building, 40 ft by 100 ft, and the Bureau Standard Arch Rib Steel Building, 40 ft by 100 ft, is reported. The criteria used for the theoretical design and installation of various skylighting patterns are described. The methods for obtaining measurements of interior illumination and the resulting data are discussed.

Preload Co., Inc., New York.
CLASSIFICATION OF PRESTRESSED CONCRETE BRIDGES IN THE UNITED STATES AND WESTERN EUROPE. Rept. on Contract DA 44-009-eng-3220. Feb 58, 115p. 12 refs.
Order from OTS $2.50 PB 131 950

This concept of prestressed concrete is based on methods of introducing stresses into a concrete structure which are opposite to those which will occur due to the dead load of the structure and the live loads to be applied. High strength steel tendons are placed in the structure and tensioned against concrete. The design is usually conceived so that the concrete will have no tension at working loads. Practical application of prestressed concrete depends on high strength concrete, high strength steel, and devices for tensioning and anchoring the steel.

Electrical and Electronic Engineering

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A RADAR MAPPING DISPLAY SIMULATION AND PERFORMANCE RECORDING DEVICE, by Jospeh R. Biagioni, Robert K. McKelvey, and James F. Mousted. Rept. on Criteria for Design and

Arrangement of Displays. Sep 58, 14p. 1 ref. WADC Technical note 58-210; AD-203 396.
Order from OTS $0.50 PB 151 454

The apparatus simulates the essential display features of a fixed antenna radar mapping system. It is designed to record operator speed and accuracy in identifying various targets on strip-map display materials. Features of general interest include flexibility of application to a variety of problems involving similar materials, convenience and reliability of operation under conditions of extended use, and a high yield of data pertinent to performance. A number of structural and operating innovations have been incorporated and are described in detail for the benefit of those who may wish to employ them in their own research and development programs.

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
DEVELOPMENT OF AN ANTICIPATORY TYPE D-C OVERVOLTAGE SENSING RELAY, by J.D. Segrest. Final rept. June 57, 27p. 2 refs. Rept. no. NADC-EL-L5710.
Order from LC mi $2.70, ph $4.80 PB 135 380

Air Force Cambridge Research Center, Bedford, Mass.
CRYSTAL-CONTROLLED S-BAND EXCITER, by R. Allen and H. Whitney. May 58, 25p. AFCRC TR-58-148; AD-110 135.
Order from LC mi $2.70, ph $4.80 PB 136 048

A crystal-controlled S-band exciter designed and developed for application in the transmitter of a high-performance MTI radar has proved that crystal control of S-band radar transmitters is feasible and results in greater frequency stability than obtainable with triode and klystron stalos. Construction and measurement techniques, technical data, and a derivation for frequency stability are presented.

Air Force Cambridge Research Center, Bedford, Mass.
SAINT COMPUTER, AN ANALYSIS, by John A. Lyden, Jr. May 58, 56p. AFCRC TR-58-142; AD-152 398.
Order from LC mi $3.60, ph $9.30 PB 136 045

The SAINT computer is a Semiautomatic Analog INTercept computer, the word intercept being used as a general term to include the interdiction and return-to-base functions. The SAINT computer has the capability of directing an attack at any heading relative to the target. The computer predicts the entire intercept path and displays this prediction on a PPI; the prediction is an integral part of the computation. The simultaneous predictions of several computers can be used, visually and/or automatically, to determine possible collisions with other aircraft or terrain obstacles. The computer operation has been studied analytically, and a laboratory model tested under simulated conditions to verify and to complement the analytical study. The studies have been primarily concerned with determining the fundamental computer operations to be performed and the difficulties involved in performing them. The results of these studies, detailed in this report, indicate that the described method of intercept computation is feasible and may have considerable operational utility.

Air Force Missile Development Center, Holloman AFB, N. Mex.
RESULTS OF ACCELEROMETER SHAKE TESTS, by Max I. Rothman. Aug 58, 11p. AFMDC TN-58-13; AD-154 102.
Order from LC mi $2.40, ph $3.30 PB 136 055

Data are presented for operational investigation of specified manufacturer's characteristics for two types of acceleration transducers. The data were gathered during tests run 15 May 58 at AFMDC and 26 May 58 at WSMR. The test data presented indicate that the performance of the transducers tested only approximates that specified by the manufacturer. The great desirability of vibrational calibration of accelerometers just prior to use is clearly indicated.

American Research and Mfg. Corp., Rockville, Md.
RAPID RESPONSE MAGNETIC AMPLIFIERS, by Peter H. Sawitz. Rept. on Improved Electronic Components. Contract AF 33(616)3377. Sep 58, 54p. 239 refs. WADC Technical rept. 58-77; AD-155 897.
Order from OTS $1.50 PB 151 458

This report covers the work performed under a program for the development of rapid response magnetic amplifiers and their associated supplies. The successful development of two static magnetic power supplies is described: that of a 64.8-kc five-stage cascaded unit and that of a 6-kc single-stage unit. The development of a high-frequency transistorized power supply was unsuccessful because of the lack of suitable transistors. A rapid response magnetic amplifier with a power gain of 20,000 and a time response of 140 microseconds was constructed. The work toward still faster time responses was not completed, since the program was prematurely curtailed.

Armour Research Foundation, Chicago, Ill.
COMPATIBLE MAGNETRONS AND ANTENNAS FOR TE_{01} CIRCULAR WAVEGUIDE SYSTEMS, by Alva C. Todd and Arnold R. Vobach. Rept. on Investigation and Development of Circular Waveguide Components, Contract AF 33(616)3973. Apr 58, 24p. WADC Technical rept. 58-239, pt. 1; AD-202 557.
Order from OTS $0.75 PB 151 482

This report covers criteria for compatible magnetron and antennas for operation in the TE_{01} circular electric wave mode using the circular waveguide components under development in contract

AF 33(616)-3973. As a first step, the ratio of waveguide radius to signal free-space wavelength is optimized for waveguide driven by a composite transition, with the criteria for this selection including acceptable mode purity as well as low waveguide attenuation and high power rating. Using proper diameters for the 9.375 kmc and 35 kmc waveguide, suggestions are made for the construction of an experimental pi-mode cavity magnetron capable of directly exciting the circular waveguide in the TE_{01} wave mode. Finally, antennas suitable for direct drive from the end of the circular waveguide are discussed. Experimental radiation characteristics are given for a TE_{01} disc-cone antenna.

Armour Research Foundation, Chicago, Ill.
METAL REINFORCED CERAMIC RADOME, by Leon M. Atlas. Rept. for 1 Apr 57-30 June 58 on Radome Techniques and Components, Contract AF 33(616)5130. Oct 58, 42p. 7 refs. WADC Technical rept. 58-329; AD-155 872.
Order from OTS $1.25 PB 151 504

The brittle failure of alumina ceramics is a serious deterrent to their use in manned aircraft radomes. Consequently, attempts have been made to develop metal-reinforced alumina composites which will not be completely destroyed by failure of the ceramic. Composites containing wire screens, and perforated metal sheets and plates were prepared by hot pressing, phosphate bonding, and brazing. Flexural loading of the various composites caused failure of the ceramic component under smaller loads than are required to break an equal thickness of homogeneous ceramic. Nevertheless, the test bars did not shatter, and preserved considerable structural integrity. The impact absorption of reinforced specimens (as measured by a Charpy pendulum) depended on the thickness and type of metal and, in some cases, was ten or more times that of the ceramic alone. Thermal expansion data, moduli of elasticity, bulk densities, and some electrical measurements were carried out and are presented. In addition, composites were prepared for rain erosion evaluation at other facilities.

Armour Research Foundation, Chicago, Ill.
RESEARCH AND DEVELOPMENT OF NEW DESIGN METHOD FOR POWER TRANSFORMERS, by G.A. Forster, L.J. Stratton, and H.L. Garbarino. Final rept. for 1 May 53-30 Aug 55 on Contract DA 36-039-sc-52656. Mar 56, 305p.
Order from OTS $5.00 PB 131 968

The purpose of this investigation is the development of a new and improved method for the design of certain types of electronic power transformers. Satisfactory designs can be obtained with little or no repetitive trial procedures. The following types of transformers have been investigated during the current contract: 1. Transformers with unbalanced magnetization; 2. Current-limiting or high-reactance transformers 3. Current-limiting trans formers with unbalanced magnetization: 4. Vibrator-supply transformers; 5. Low-capacitance transformers; 6. Instrument transformers.

Babcock and Wilcox Co., Alliance, Ohio.
INVESTIGATION OF HEAT EXCHANGER MATERIALS, by Earl Howells, R.D. Wylie, and P.O. Kirchhoff. Progress rept. for July 56 on Contract NObs-72167. Aug 56, 16p. Rept. no. 5356.
Order from LC mi $2.40, ph $3.30 PB 135 869

It is the purpose of this work to test a number of materials in environments simulating those found in heat exchangers. These will include various concentrations and combinations of caustic, chlorides and oxygen. The following materials will be tested: 347; Croloy 2-1/4 ELC; Incoloy; Carbon Steel SA-212 Grade B; 302; 304 ELC; Croloy 12; Monel; Inconel; 329; 16 Cr-1Ni.

Battelle Memorial Inst., Columbus, Ohio.
ELECTRONIC GAS DISCHARGE TUBES, by J.E. Drennan and G.B. Gaines. Final rept. on Contract DA 36-039-sc-63213. 15 June 55, 41p. 16 refs.
Order from LC mi $3.30, ph $7.80 PB 135 905

This project is primarily concerned with the development of improved voltage-regulator tubes.

Chatham Electronics, Livingston, N.J.
RESEARCH STUDY AND DEVELOPMENT OF CLIPPER TUBE, GAS FILLED, by Arthur J. Moses. Final type rept. covering phase I, 15 Feb 55-30 Sep 56, on Contract DA-36-039-sc-64621. 30 Sep 56, 208p.
Order from LC mi$9.30, ph $31.80 PB 136 040

The investigation clearly indicated that a gas tube clipper in an end of line matched impedance clipper circuit offers most advantageous operaton at all power levels up to the 5948/1754 level. Included in this report is information necessary for a designer to compute the desired ratings of a clipper tube from the design data of the modulator circuit. The results of this report will be used to design an optimum clipper tube for service at the 5948/1754 power level.

Dalmo Victor Co., San Carlos, Calif.
MAGNESIUM WAVEGUIDE INVESTIGATION AND DEVELOPMENT, by Glenn Chamberlain. Final engineering rept. May 55-Feb 57 on Contract AF 30(635)2850. 260p. 55 refs. Rept. no. R-681-1523; RADC TR 57-65; AD-114 387.
Order from LC mi $11.10, ph $38.60 PB 136 208

Contents:
Magnesium waveguide development wall thickness study, by Glenn J. Chamberlain. Rept. no. R-681-1206-D
The effect of waveguide wall thickness on dimensions versus pressure, by John D. Campbell. Engineering test rept. no 500-2
Effect of internal air pressure on vswr and wave-

length for 1-1/2 x 3 inch waveguide (R.A.D.C. waveguide study) by Daniel F. Connell. Rept. no. R-681-1497

Change in wavelength due to distortion of waveguide, by A.S. Dunbar. Rept. no. R-681-1515

Summary of literature survey on magnesium waveguide, by Glenn J. Chamberlain. Rept. no. R-681-1268

Electroplating of magnesium alloys. Rept. no. R-681-1523

Protective coatings for magnesium waveguide, by Glenn J. Chamberlain. Rept. no. R-681-1509

Salt spray test of magnesium finishes, by L.V. Omelka. Rept. no. R-681-1501

Roughness and rectangularity limits for waveguides, by Glenn Chamberlain. Rept. no. R-681-1517

Diamond Ordnance Fuze Labs., Washington, D.C.
FREQUENCY VARIATIONS OF THE HYBRID-PI EQUIVALENT CIRCUIT JUNCTION TRANSISTORS, by E.H. Harrison, Jr. 10 Mar 58, 37p. 14 refs. TR-572.
Order from LC mi $3.00, ph $6.30 PB 136 026

The frequency dependence of the elements of the hybride-Pi equivalent circuit of an idealized, one-dimensional junction transistor is predicted from design theory. The usefulness of the low-frequency, lumped-constant equivalent circuit is found to extend to frequencies of the order of the inherent alpha cut-off frequency, at which phase shift errors of the order of 20 degrees are encountered. At higher frequencies the equivalent circuit elements must be treated as frequency dependent quantities. Results of the analysis are presented in the form of graphs and tables.

Diamond Ordnance Fuze Labs., Washington, D.C.
LATERAL-CURRENT CONTROL OF COLD-CATHODE GAS DISCHARGES, by D.J. Belknap, L.R. Crump, and M.J. Reddan. 30 June 58, 18p. Technical rept. TR-628.
Order from LC mi $2.40, ph $3.30 PB 136 028

Among applications utilizing lateral-current control which have been demonstrated in this laboratory are (1) a sensitive trigger tube, (2) a cold-cathode light indicator for computer use, (3) a binary switch providing on-off, off-on switching, (4) an amplifier, (5) an electric field detector, (6) a rectifier and touch control switch, (7) a relaxation oscillation synchronizer and (8) a time delay switch.

Diamond Ordnance Fuze Labs., Washington, D.C.
SENSITIVE PHASE METER, by Frank Vrataric. 20 June 58, 11p. 2 refs. TR-618.
Order from LC mi $2.40, ph $3.30 PB 136 027

This meter is capable of measuring the very small time difference that exists between corresponding pulses of two nearly coincident pulse chains. This method utilizes electronic switching techniques that periodically reverse the two input connections to a phase indicator. The output of the phase indicator is integrated and the resulting waveform is an ac signal, at the switching rate, whose amplitude is directly proportional to the time difference between the input signals. This ac signal is converted to dc by a diode synchronous detector synchronized with the electronic switch. This provides the sign of the time difference as well as its magnitude.

Eagle-Picher Co., Joplin, Mo.
WATER ACTIVATED BATTERIES, by M.F. Chubb, E.E. Spracklen, and G.R. Long. Final rept. on Contract DA-36-039-SC-63210. 1 June 56.
Order from LC mi $2.40, ph $3.30 PB 135 904

For radiosonde use.
Test batteries were made and are being tested

Emerson Radio and Phonograph Corp., Jersey City, N.J.
RADIO FREQUENCY TUNERS AND I-F AMPLIFIERS FOR TRANSISTORS, by Edward A. Abbott. Rept. for 1 Feb 57-31 Jan 58 on Improved Electronic Components, Contract AF 33(600)31464. Oct 58, 28p. WADC Technical rept. 57-256, pt. 2; AD-204 091.
Order from OTS $0.75 PB 151 545

Miniaturized transistorized i-f amplifiers which can withstand shock, vibration, and temperature conditions between 0°C and 70°C have been designed and constructed and have the following characteristics: Center Frequency, 1 mc, 15 mc; 6-db Bandwidth, 8.8 kc, 13.0 kc; 60-db Bandwidth, 21.2 kc, 25.0 kc; Power Gain, 80 db, 76 db. A 30-mc i-f amplifier breadboard with a 51.7-db gain, a 6-db bandwidth of 150 kc, and a 60-db bandwidth of 500 kc has also been constructed. Three permeability-type miniature r-f tuners to track three tuned circuits in the frequency ranges of 1.5 to 5.0 mc, 5.0 to 15.0 mc, and 15 to 45 mc have been designed and constructed. A technique of temperature compensating high-Q ferrite-cored coils has been discovered.

General Electric Co., Owensboro, Ky.
STUDY OF ELECTRON TUBE SHORTS AND DISCONTINUITIES, by William A. Barrows and Clarence L. Reynolds. Rept. on Electronic Tubes and Transistors, Contract AF 33(600)32562. June 58, 188p. WADC Technical rept. 57-716.
Order from OTS $3.00 PB 151 489

This investigation concerns the problem of short testing electron tubes. In the past, repeatability of short detectors was evaluated with tubes. This was not satisfactory because most temporary shorts are by nature not repeatable. A Simulated Short Generator was developed and an evaluation of different detectors was made. The Simulated Short Generator was also used to study the levels at which shorts become objectionable in electronic equipment. A study was made to determine the nature of temporary shorts. The results of these studies indicate that for a short to be objectionable in operating equipment, the short had to have a time-resistance

relationship. As the resistance of the short increased, the time for it to be objectionable would also have to increase. The study made of the nature of shorts in tubes indicates that as the resistance of the short increased, the time decreases. From these investigations a time-resistance curve was determined that would define an objectionable short.

Horizons, Inc., Cleveland, Ohio.
FERROELECTRIC DEVICES, by Richard A. Fotland and Edward F. Mayer. Rept. for 15 Mar 57-31 May 58 on Improved Electronic Components, Contract AF 33(616)5125. Oct 58, 75p. WADC Technical rept. 58-347; AD-204 093.
Order from OTS $2.00 PB 151 484

An investigation of ferroelectric crystals and their utilization in ferroelectric second-harmonic amplifiers has demonstrated that such amplifiers are impractical unless much better materials become available. Amplifiers using barium titanate crystals and having power gain-bandwidth products of 56,000 have been constructed. The principal limitation for successful operation is crystal heating due to hysteresis losses at high fields. Crystals heating results in a serious loss in nonlinearity as the Curie temperature is exceeded. Attempts to grow high Curie temperature crystals were unsuccessful. Ferroelectric ceramic niobate materials have been examined for suitability of operation as binary storage elements. Both a conventional and a novel type of nondestructive harmonic read-out system were investigated. With pulse read-out, undisturbed discrimination ratios of five and switching times of 0.05 microsecond were obtained. While one-half disturb pulses did not switch the ceramics, these pulses did reduce the polarization below the limit for effective coincidence array storage using pulse read-out. Successful storage operation was obtained with the harmonic read-out system. Several million read-outs and several million on-half disturb pulses did not destroy the stored information. Several ten by ten matrices were fabricated and tested element by element. Every element functioned in two of these matrices.

Houghton Labs., Inc., Olean, N.Y.
PROTECTIVE INSULATING COATINGS FOR PRINTED CIRCUITRY AND/OR PRINTED CIRCUIT ASSEMBLIES, by Mark V. Goodyear and Alphonse Melfi. Quarterly rept. no. 3, 1 Sep-30 Nov 57, on Contract DA 36-039-sc-73190. Dec 57, 37p.
Order from LC mi $3.00, ph $6.30 PB 135 740

Lincoln Lab., Mass. Inst. of Tech., Lexington.
COMMUNICATION THROUGH NOISY, RANDOM-MULTIPATH CHANNELS, by George Turin. Rept. on Contract AF 19(122)458. 14 May 56, 106p. 38 refs. Technical rept. no. 116.
Order from LC mi $5.70, ph $16.80 PB 130 885

Statistical methods are applied to the problem of communication through a multipath channel which has random (or unknown) path characteristics, and which has additive random noise present at the reciever end. In an introductory chapter, the transmitter of a system for use with such a channel is defined as one which encodes the output of an information source into a sequence of selections from a finite set of message waveforms, and transmits this sequence into the set of message waveforms, and transmits this sequence into the channel. The receiver is specified as one which, on reception of the channel-perturbed transmitted signal, computes a posteriori probabilities of the possible transmitted message-waveform sequences, and, on the basis of these, supplies guesses at the information source output to an information user.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
PUNCH-THRU DIODE (OPERATION AS A NARROW-BASE DIODE), by R.H. Rediker and D.E. Sawyer. Rept. on Contract AF 19(122)458. 27 Nov 56, 28p. 19 refs. Technical rept. no. 137.
Order from LC mi $2.70, ph $4.80 PB 130 878

The punch-thru diode is a planar junction diode with a very narrow base width. Three techniques which have been used to manufacture punch-thru diodes are described. The current-voltage relationship of this diode is a function of the degree of imperfection of the ohmic contact. If it were possible to make the ohmic contact perfect, the diode would exhibit extremely poor rectification. The rectification ratio for practical ohmic contacts, however, is of the order of 10^5 to 10^6. The alloyed-junction current-voltage characteristics follow very closely the [exp (qV/akT)-1] relationship with values of a between 1.02 and the theoretical value 1.00. Because of the narrow base width, the series bulk resistance for typical designs is between 0.3 and 3 ohms. Thus the entire range of forward currents can be obtained at low forward voltages. Because of its narrow base width, the diode is a high-frequency device both for small-signal applications and for switching applications. Small-signal applications at UHF are discussed. In switching applications the reverse recovery time is limited as much by junction capacitance as by hole-storage effects. A switching-diode design that switches at speeds up to 5 Mcps is described. The low forward-voltage drop and high-frequency capability make this switching diode unique.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
TOPICS IN THE DESIGN ANTENNAS FOR SCATTER, by John Granlund. Rept. on Contract AF 19(122)458. 23 Nov 56, 120p. 22 refs Technical rept. no. 135.
Order from LC mi $6.00, ph $18.30 PB 130 880

Unlike the signal received over a line-of-sight path, scatter signals arrive at the receiving site from a continuum of directions with intensities that may be described by a directional pattern similar to an antenna pattern. This report shows how the mean signal power available at the terminals of a receiving antenna may be expressed in terms of the antenna pattern and of a pattern of incoming power density. Methods of measuring the power-density pattern at

the receiving site are discussed. Designs maximizing the available power are obtained for two rather general types of antenna when they are illuminated by arbitrary power-sensity patterns. Numerical results, obtained for an assumed Gaussian-shaped power-density pattern, suggest that only a very small increase in available power may be obtained by readjusting the pattern of an antenna that was initially adjusted to have maximum plane-wave gain in the direction of maximum power density. A large array of small antennas may be subject to "gain loss" but, if the connections between array elements are allowed to vary in time at the fading rate, the array will not exhibit "gain loss." Appropriate electronic circuitry for the inter-connections is discussed.

Microwave Development Labs., Inc., Wellesley, Mass.
INVESTIGATIONS AND DEVELOPMENT ON BROAD BAND SINGLE SLOT WAVEGUIDE HYBRID COUPLERS, by Edward Salzberg and H.J. Riblet. Final progress rept. for 15 Sep 52-1 Mar 55 on Contract DA 36-039-sc-15563. 1 Mar 55, 46p.
Order from LC mi $3.30, ph $7.80 PB 136 111

This report describes the work done in improving the design of broad band single slot waveguide hybrid couplers. In particular, design parameters are given which enable one to design hybrid couplers which cover the frequency range 2600 to 3950 mc/s in RG-48/U in three steps. Another design is given for the single slot hybrid coupler covering the frequency range 8450 to 9650 mc/s in RG-51/U waveguide.

Microwave Lab., Stanford U., Calif.
DEVELOPMENT OF HIGH-POWER TRAVELING-WAVE AND HYBRID TUBES, by M. Chodorow. Scientific rept. no. 7, 15 Jan-15 Apr, on Contract AF 19(604)1924. May 58, 29p. M L rept. no. 503; AFCRC TN-58-143; AD-152 370.
Order from LC mi $2.70, ph $4.80 PB 136 050

In the cloverleaf traveling-wave tube project, the most recent tube built, after some modification, operated at a small-signal gain approaching 40 db without serious instability. A maximum power output exceeding 3 megawatts was obtained, with an efficiency of approximately 33 per cent, and a gain of almost 35 db. The observed bandwidth under these conditions was 9 to 10 per cent. In the high-power, broadband tube structures project, a tube is now in design and construction of some components has started. This tube uses the 24-loop section of the "centipede" design as the basic structure. Additional studies are continuing on the characteristics of loop-coupled structures and on methods of differential attenuation for such tube structures. In the grid-controlled, high-power gun project, a study has been made of the cutoff characteristics of the gun. The beam current was reduced to less than 10 microamperes with a bias of -270 volts at a beam voltage of 100 kv. Very little indication of a remote cutoff characteristics has been observed, the beam current decreasing uniformly with increasing bias down to a beam current of 200 microamperes or less.

Minneapolis-Honeywell Regulator Co., Minn.
A RESEARCH STUDY OF HOT GAS SERVOMECHANISMS, by R.L. Kramer. Final rept. on Contract AF 33(616)3146. Feb 58, 103p. WADC Technical rept. 58-41; AD-142 322.
Order from OTS $2.50 PB 151 450

A study was made of hot gas generation and utilization in a converter to produce hydraulic power. Hydrazine was chosen as the fuel from among the solid and liquid propellants studied. A generator capable of producing hot gas at 3000 psi was constructed and found to have satisfactory steady-state and transient operating characteristics. A study was made of gas leakage past the piston in a gas-to-hydraulic converter. As a result of this study, a converter is recommended with separate gas and hydraulic pistons to avoid contamination of the hydraulic fluid by the leakage gas. A method of increasing fuel efficiency through utilization of expansion energy from the high pressure gas is suggested.

Naval Research Lab., Washington, D.C.
NAVAL DATA HANDLING SYSTEM PICKOFF DISPLAY CONVERTER, by F.R. Fluhr and D.J. McLaughlin. 8 Jan 59, 41p. 7 refs. NRL rept. 5248.
Order from LC mi $3.30, ph $7.80 PB 136 357

A number of techniques developed at the U.S. Naval Research Laboratory for the processing of tactical data have been integrated into the Naval Data Handling System for the purpose of studying the effects of their interaction and collective contribution to overall system performance. One such device, the Pickoff Display Converter, is used to derive cartesian-coordinate voltages from a manually directed probe in contact with a conducting-glass overlay and to insert these voltages, representing target-position coordinates, into a radar plan-position indicator to display a reference marker during the radar repeater retrace time. Because the system accuracy is dependent upon these units, the Pickoff Display Converter has been made more simple, rugged, and accurate than earlier versions of the Electronic Pencil Coordinators and Retrace Insertion Units. The device is used with the AN/SPA-8A repeater, but with minor modifications the retrace insertion circuitry may be used with any repeater having fixed-coil or resolved-sweep deflection systems. Switching methods have been revised to allow insertion of a marker into the SPA-8A repeater in less than 180 micro-seconds. Rubber-range circuits have been incorporated such that any range changes made on the radar repeater will allow constant probe sensitivity with respect to the inserted marker. A differential mode of marker control with the electronic probe has been incorporated, permitting the marker to be repositioned only when the probe is moved when in contact with the transparent conducting surface of the glass overlay.

Pacific Semiconductors, Inc., Culver City, Calif.
INDUSTRIAL PREPAREDNESS STUDY ON DIFFUSED JUNCTION SILICON HIGH SPEED COMPUTER DIODE, by S.H. Barnes, P.H. Dirnbach and others. Final rept. for 26 Apr 56 - 16 Sep 57 on Contract DA 36-039-sc-70274. Oct 57, 198p. In cooperation with Ramo Wooldridge Corp.
Order from LC mi $8.70, ph $30.30 PB 136 001

Pilot tooling and equipment produced, pilot plant cost and capacity, as well as pilot product manufacturing cost, are described.

Polacoat, Inc., Blue Ash, Ohio.
REDUCED REFLECTIONS IN PHOSPHORS: THEORY AND EXPERIMENT, by John F. Dreyer. Rept. on Electronic Tubes and Transistors, Contract AF 33(616)5079. Oct 58, 12p. WADC Technical rept. 58-354; AD-202 560.
Order from OTS $0.50 PB 151 486

The theory and process are given for preparation of cathode ray tubes with reduced phosphor reflection obtained by incorporation of the phosphor in a glaze of close refraction index match. Resulting tubes had an improvement of two and a half times in the ambient light reflection.

Radio Corp. of America, Harrison, N.J.
DEVELOPMENT OF IMPROVED GUNS FOR CATHODE RAY TUBES, by D.W. Clark. Rept. on Electronic Tubes and Transistors, Contract AF 33(600) 32608. Oct 58, 21p, 3 refs. WADC Technical rept. 58-177; AD-202 555.
Order from OTS $0.75 PB 151 503

This contract calls for the development of a tube directly interchangeable with the 10UP14A, but improved with respect to focus quality and change of focus with drive. Line widths much better than those specified for the 10UP14A were attained, but difficulty was encountered in focusing screen currents of the order of one milliampere. The chief causes were focus lens distortion and space charge defocusing.

Rome Air Development Center, Griffiss AFB, N.Y.
DESIGN CONSIDERATIONS FOR THE RADIOISOTOPE THERMOELECTRIC GENERATOR, by F.B. Brauer, J.L. Briggs and others. Jan 57, 87p. 58 refs. RADC TR-56-130; AD-97 849.
Order from LC mi $4.80, ph $13.80 PB 135 315

This report consists of five sections, each of which is part of a predevelopment feasibility study of the radioisotope thermoelectric generator. The program is described in general, and thermoelectric design considerations, radioisotope source design and shielding are examined in detail. The design of a handling facility is described and a typical electronic application of the device is discussed. The conclusions of this feasibility study are that it is possible to build a practical model of the radioisotope thermoelectric generator and that such a device will have certain unique and desirable performance characteristics not presently attainable by conventional methods.

Rome Air Development Center, Griffiss AFB, N.Y.
RELIABILITY PREDICTION AND TEST RESULTS ON USAF GROUND ELECTRONIC EQUIPMENT, by Joseph J. Naresky. July 58, 25p. RADC TN-58-177; AD-148 794.
Order from OTS $0.75 PB 151 041

This is a progress report on the development of a prediction technique which will enable a designer to predict the quantitative reliability his equipment will achieve in the field. It is felt the results to date are sufficiently significant to be reported, and indicate the technique is valid enough to be used by engineers and scientists for analyzing and increasing the reliability of their equipments. The report described the development of a technique for predicting ground electronic equipment reliability; its application to several representative items of equipment (AN/GRC-27, AN/FPS-3, AN/GPX-20) a comparison between the predicted figures and those obtained by laboratory and field tests of the equipment; an analysis of the results to date and their usefulness; and recommendations on methods for refining and improving the technique.

Sylvania Electric Products, Inc., Woburn, Mass.
INDUSTRIAL PREPAREDNESS STUDY FOR SUPER S-BAND MIXER CRYSTALS, by R.E. Bayliss, E.J. Feldman and others. Final rept. on Contract DA 36-039-sc-66037. 31 Jan 57, 172p.
Order from LC mi $8.10, ph $27.30 PB 128 280

The engineering work on this contract has been completed. The original and final specifications are included in this report. A reversible low noise figure S-band diode hss resulted. This diode is hermetically sealed and operates at 150°C. It will withstand MIL shock test, vibration and spin tests. Equipment and facilities for production of this diode are described.

Syracuse U., Research Inst., N.Y.
EVALUATION OF TEFLON HOOK-UP WIRE, by LeRoy Allen Mullin. Final rept. for 15 June 54 - 15 Feb 56 on Contract DA 36-039-sc-63195. June 56, 269p. Rept. no. EE307-566F.
Order from LC mi $11.10, ph $40.10 PB 136 002

The object of this program is the evaluation of commercially available Teflon insulated hook-up wire to enable the establishment of specification requirements for the procurement of such wire. The physical and electrical properties within the temperature range of -65°C to +250°C have been evaluated in accordance with prescribed test procedures.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
PRELIMINARY TESTS OF A PRECISION VHF OMNIRANGE, by Sterling R. Anderson, Robert B. Flint and others. Aug 58, 17p. 3 refs. Technical Development rept. no. 355.
Order from OTS $0.50 PB 151 317

This report presents the theory and results of the preliminary development and testing of a new precision VHF omnirange in which omnibearing information is produced by radiating, in effect, a rotating 10-lobe radio-frequency sideband pattern in contrast to the rotating 2-lobe pattern of a conventional omnirange. Theoretically, a 5 to 1 improvement is possible in bearing accuracy and substantial reduction of course scalloping caused by reflecting objects can be effected. An experimental model of the precision omnirange, using 21 loops, was installed at the CAA Technical Development Center, Indianapolis, Indiana. The measured bearing accuracy was plus or minus 0.35^{o}. The maximum course scalloping caused by reflections from a horizontal wire 200 feet in length and 30 feet high was 30.6 per cent of the scalloping associated with a conventional 4-loop omnirange at the same site. Later, measurements of course scalloping caused by reflections from groups of trees were made at a decommissioned five-loop omnirange site at Dayton, Ohio, using the same experimental equipment. The maximum course scalloping at this site was the same for both antenna systems; however, the azimuthal area of scalloping on the precision omnirange was only 27.4 per cent of the area of scalloping on the 5-loop omnirange. On radial flights, a reduction in course bends varying from 2 to 1 to 6 to 1 was measured on the precision omnirange. Polarization errors measured in flight were negligible.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
STANDARDIZATION OF VOR RECEIVER-RECORDER SYSTEM RESPONSE, by Henry C. Hurley, Thomas S. Wonnell and John A. Beck. Dec 58, 20p. 1 ref. Technical Development rept. no. 274.
Order from OTS $0.75 PB 151 346

This report presents the results of tests conducted at the Technical Development Center of the Civil Aeronautics Administration to develop a method for standardizing the VOR receiver-recorder system of flight inspection aircraft in order to provide uniform inspection data. It is concluded that with the use of tantalytic capacitors and a standardized method of adjusting the damping factor of the aircraft equipments, a satisfactory uniformity of flight inspection recordings can be obtained.

Transistor Products, Inc., Waltham, Mass.
INDUSTRIAL PREPAREDNESS STUDY ON POWER TRANSISTORS, by P.W. Erickson and J.F. Battey. Quarterly progress rept. no. 6, 1 Apr-30 June 30 June 55, on Contract DA 36-039-sc-46613. July 55, 27p. 3 refs. (In cooperation with Clevite Corp.)
Order from LC mi $2.70, ph $4.80 PB 136 090

A study has begun of the low voltage operation of the present power transistor types with a view to changing designs slightly to improve performance at low voltages. Equipment has been set up for making silicon alloy junctions. This equipment is now in operation and initial results on the few diodes and transistors so far made are promising.

Western Union Telegraph Co., New York.
TELETYPEWRITER MULTI-POINT SELECTIVE SIGNALING EQUIPMENT, by G.G. Light. Final rept. for 21 June 54-25 Mar 56 on Contract DA 36-039-sc-64496. 30 Mar 56, 133p.
Order from LC mi $6.90, ph $21.30 PB 136 005

The primary purpose of the project is the development of a teletypewriter multi-point selective signaling system whereby a fixed semi-automatic relay station can send messages selectively to a plurality of fixed semi-automatic tributary stations on the same circuit and/or can select the several tributary stations in turn to permit the transmitter there to send a message to the relay station.

Ordnance, Missiles, and Satellite Vehicles

Air Force Cambridge Research Center, Bedford, Mass.
A BIBLIOGRAPHY OF THE ELECTRICALLY EXPLODED WIRE PHENOMENON, by William G. Chace. Nov 58, 25p. 427 refs. GRD Research notes no. 2; AFCRC TN-58-457; AD-152 640.
Order from OTS $2.00 PB 151 462

Original abstracts, from reading of EWP articles, and abstracts taken from Physics Abstracts, Transactions of IRE, Chemical Abstracts, etc., are compiled. The arrangement is by subject group, alphabetical by authors, and inverse chronological for articles by any one author.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPANDABLE FLASH X-RAY TUBE, by George Hauver and George Bryan. Mar 53, 7p. 3 refs. Memo rept. no. 647.
Order from LC mi $1.80, ph $1.80 PB 135 513

For the flash radiography of explosive phenomena, an expendable x-ray tube may be used without protective shielding, facilitating flexible instrumentation. Experimental expendable tubes of the field emission type are described, along with preliminary performance data.

Bureau of Ordnance, Navy Dept., Washington, D.C.
COMMENT ON THE LINEAR DYNAMIC STABILITY CRITERIA FOR BALLISTIC MISSILES, by John D. Nicolaides. Dec 56, 12p. 8 refs. Ballistic Technical note no. 30.
Order from LC mi $2.40, ph $3.30 PB 135 079

The Epicyclic Theory for the flight dynamics of ballistic missiles has yielded various "Dynamic Stability Criteria" which are often used to evaluate missile performance. Recent misleading uses of the theory and criteria in appraising missile performance require a simple restatement of the theory, its assumptions, and its use.

Chemical [Warfare] Labs., Army Chemical Center, Md.
INCENDIARY GELS AND THEIR INSTRUMENTATION. REPORT OF SYMPOSIUM VI, 21-22 JUNE 1954, PART I. Dec 54, 132p. 53 refs.
Order from LC mi $6.90, ph $21.30 PB 135 331

Table of Contents:
General applications of incendiary gels in munitions
Stoichiometry of aluminum soap precipitation
Manufacturing variables for napalm type soaps
Commercial manufacture of octal type soaps
Mechanism of peptization of aluminum soap-hydrocarbon gels based upon infrared studies
Evaluation of structures of soaps and gels by light-scattering methods
The rheogoniometer and allied instruments

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N.J.
USE OF SALINE LEACHES TO STABILIZE NITROCELLULOSE, by Ruth N. Shelley and Samuel Helf. Sep 58, 18p. 7 refs. Technical rept. 2550; AD-163 403.
Order from LC mi $2.40, ph $3.30 PB 136 833

Studies are described evaluating the use of a cold saline leach in combination with short aqueous boils to produce a stable mitrocellulose from cotton linters. The 100°C vacuum stability test was superior to the 134.5°C German heat test in detecting differences between samples. The vacuum stability test showed that a combination of a 4-hour cold saline leach and a 10-hour water boil, before the standard beating and poaching operation, resulted in a pyrocellulose (12.6% nitrogen) comparable in stability to a sample boiled for 40 hours. However, the substitution of a saline leach for boiling time appeared to have no advantage for grade B (13.45%N) nitrocellulose.

Hydrodynamics Lab., Calif. Inst. of Tech., Pasadena.
FREE-BODY MODELING OF THE DYNAMICS OF .. FIN-STABILIZED BALLISTICS MISSILE IN NON-SPINNING VERTICAL TRAJECTORIES, by Donald A. Price, Jr. Rept. on Contract NOrd-16200, Task I. Apr 57, 68p. 3 refs. Rept. no. E73.1.
Order from LC mi $3.90, ph $10.80 PB 135 080

Part 1 of an experimental and analytical investigation of the behavior in free flight of inertia-propelled bodies that are fin-stabilized is presented. The dynamic response in vertical trajectories starting from rest has been found for two sizes of a single configuration of the Basic Finner Research Missile with a variety of model parameters and initial conditions.

National Advisory Committee for Aeronautics, Washington, D.C.
APPROACH TO THE PROBLEM OF ESTIMATING SEVERE AND REPEATED GUST LOADS FOR MISSILE OPERATIONS, by Harry Press and Roy Steiner. Sep 58, 44p. 10 refs.
Order from NASA* NACA TN-4332

An analysis of available information on atmospheric turbulence is presented in order to arrive at a simple description of the atmospheric turbulence environment appropriate for missile operations. This simplified description is utilized to derive methods of estimating severe and repeated gust loads in missile operations in terms of missile response characteristics and operating parameters for given probabilities of exceedance.

Naval Research Lab., Washington, D.C.
NRL PARTICIPATION IN THE CSAGI ROCKET AND SATELLITE CONFERENCE, SEPTEMBER 30-OCTOBER 5, 1957, Interim rept. 5 Jan 59, 127p. NRL Rept. 5165.
Order from OTS $2.75 PB 131 960

An international conference on rocket and earth satellite programs for the International Geophysical Year was held in Washington from September 30 to October 5, 1957. This symposium provided the first formal opportunity during the IGY for participating nations to engage in an active exchange of information on modern techniques of research rockets and astrophysics. The conference was called by the Comité Spécial L'Année Géophysique Internationale (CSAGI), which asked the National Academy of Sciences to act as host. The conference brought together delegates from the various national committees participating in research rocket and as satellite programs. The chairman was L.V. Berkner, CSAGI reporter on rockets and satellites and President of the Internation Council of Scientific unions. Executive Director Hugh Odishaw, of the U.S. National Committee, IGY, was Chairman of the General Arrangements Committee. NRL participation in the IGY has been preponderantly in the field of upperair research; it was natural, then, that NRL papers delivered at the conference concern the development and use of rockets in research. These papers cover NRL earth satellites, their development and instrumentation, and the rocket vehicles which are used to propel them into orbit. Dr. John P. Hagen submitted the first NRL paper, which gave a comprehensive look at both the satellite and the vehicle. Subsequent papers submitted by NRL Scientists and engineers covered such details of the Vanguard operation as the Minitrack system, optical tracking, satellite structure, satellite instrumentation, telemetering, and some of the experiments which will be carried out, including

*National Aeronautics and Space Adminstration, 1520 H Street, N.W., Washington 25, D.C.

Lyman-alpha and magnetic field measurements and ionospheric study. The satellite environment was covered in papers on atmospheric drag, satellite temperature control and measurement, and measurement of micrometeor impingement. Papers were also given which covered NRL upper-air research at Fort Churchill, White Sands Proving Ground, and other stations throughout the world, from Baffin Bay to the Antarctic. These were largely comfined to the preliminary results obtained during pre-IGY and early IGY rocket firings. One paper describes the Aerobee-Hi, a rocket specifically designed for high-altitude research.

Rock Island Arsenal Lab., Ill.
USE OF VOLATILE CORROSION INHIBITORS AS A PRESERVATIVE MEDIUM FOR LONG TERM STORAGE OF ORDNANCE MATERIALS. ADDENDUM VI. RESULTS AFTER EIGHT YEARS OF EXPOSURE, by Robert E. Johnson. 19 June 58, 33p 2 refs. Rept. no. 58-1591.
Order from LC mi $3.00, ph $6.30 PB 136 144

After eight years in storage, two volatile corrosion inhibitors and three petrolatum type corrosion preventives employed in packaging stored Ordnance materiel were evaluated to determine their ability to prevent rusting and to establish the total amount of residual inhibitor on the wrapper.

School of Aviation Medicine, Randolph AFB, Tex.
STUDY OF METHODS OF GUN SIGHTING AT EXTREMELY LOW LEVELS OF ILLUMINATION, by William M. Roland. Rept. no. 1 on Proj. 82. 23 Sep 42, 10p. AD-135 619.
Order from LC mi $1.80, ph $1.80 PB 136 197

By proper use of the poracentrol retina it is possible for trained observers to sight a gun at a dark object seen against a background the brightness of which is considerably below the foveal threshold, and to shoot with a moderate degree of accuracy.

Vitro Corp. of America, Eglin AFB, Fla.
TWO-STATION YAW CALCULATION, by Gerald W. Findley. Rept. on Contract AF 08(616)50. Oct 57, 14p. AFAC TR-57-108; AD-142 368.
Order from LC mi $2.40, ph $3.30 PB 136 077

A method for finding the angle of yaw is discussed in which the directions of the longitudinal axis and the velocity vector of the bomb must be determined at the same instant and at succeeding equally spaced intervals. This data is acquired by 2 phototheodolites and is used for computing direction cosines of the velocity vector and the longitudinal axis of the bomb, and the yaw and yaw characteristics. This method is accurate mathematically, but inaccuracies occur in determining the angular attitude of the bomb in the film plane. The angle of yaw was estimated at about $\pm 10^{o}$

Sanitation and Safety Engineering

[Army] Engineer Research and Development Labs., Fort Belvoir, Va.
PURIFICATION OF WATER CONTAMINATED WITH RADIOACTIVE MATERIAL, "WAHOO", by William J. Lacy and Don C. Lindsten. Interim rept. 24 Dec 52, declassified 8 Mar 54. 78p. Rept 1275.
Order from LC mi $4.50, ph $12.30 PB 136 037

This report covers the results of a laboratory and field water supply equipment and water treatment processes now standard and under development with respect to radioactive contamination and decontamination. Work is still in progress on the project.

[Army] Engineer Research and Development Labs., Fort Belvoir, Va.
REMOVAL OF RADIOACTIVE MATERIALS FROM CONTAMINATED WATER BY THERMOCOMPRESSION DISTILLATION, "WAHOO II", by William J. Lacy, Don C. Lindsten, and Harry N. Lowe, Jr. 28 Aug 53, declassified 8 Mar 54. 47p. 7 refs. Rept. 1313.
Order from LC mi $3.30, ph $7.80 PB 136 038

This report describes experimental work accomplished pertaining to the removal of radioactive materials from contaminated water by thermocompression distillation.

[Army] Engineer Research and Development Labs., Fort Belvoir, Va.
REMOVAL OF RADIOACTIVE SUBSTANCES FROM WATER BY ION EXCHANGE PROCESSES, "SALTY DOG I", by William J. Lacy and Don C. Lindsten. 11 June 54, declassified 18 Sep 57. 61p. 8 refs. Rept. 1357.
Order from LC mi $3.90, ph $10.80 PB 136 024

This report covers the results of an investigation using ion exchange processes and clay slurrying for removing radioactive materials from water, with the view towards adaptation to the U.S. Army water purification equipment. Laboratory studies were made followed by pilot plant studies using typical granular ion exchange resins for removing fission products contamination from Oak Ridge tap water. The report concludes that: 1. Granular ion exchange materials used as a column are effective for the decontamination of radioactively contaminated water in the equipment size and capacity commensurate with existing military water supply equipment. Optimum results can probably be obtained by employing the column after the conventional coagulation and diatomite filtration steps. 2. Waste powdered ion exchange materials or clay used as a slurry are effective for the decontamination of radioactivity contaminated water. Optimum results can probably be obtained by using the process as a pre-treatment procedure prior to the conventional coagulation and diatomite filtration steps. The report makes no recommendations.

Army Environmental Health Lab., Army Chemical Center, Md.
EXPERIMENTAL STUDY ON RINSE TEMPERATURE REQUIREMENTS FOR ARMY SINGLE TANK DISH-WASHING MACHINES, by Frederich J. Post, Robert G. McCall and others. Apr 55, 16p. 17 refs.
Order from LC mi $2.40, ph $3.30 PB 135 191

A study was made of single tank machine dishwashing of compartmented trays using manifold rinse temperatures of 160, 170 and 180°F at the rate of 5 gpm for 20 seconds following a 40-second wash at 140°F. A capillary tube technique was devised to eliminate the influence of mechanical removal and the masking effect of soil residuals and to provide a quantitative method of determining kill of the test organism, Micrococcus caseolyticus. The following conclusions were reached: (a) A wash of 140°F for 40 seconds, followed by a rinse of 180°F for 20 seconds at 5 gpm yields from the standpoint of pathogens a bacteriologically clean surface. These time-temperature conditions include a factor of safety to account for size and configuration of trays, volume of hot water, thermal lag of the eating utensils, cooling of rinse water, unreliability of washing machine thermometers, the presence of adhering soil, and other unforeseen factors which might prevent the eatingware from reaching a "pasteurizing" time-temperature. (b) Rinse temperatures of 170°F or 160°F do not provide adequate protection. (c) The essential requirement is that the entire tray reach a temperature above 160°F for a sufficient time to "pasteurize" and that 180°F at the manifold is the only sure way of accomplishing this.

Kidde, Walter, and Co. Inc., Belleville, N.J.
AN ENGINEERING STUDY OF AIRCRAFT CRASH-FIRE PREVENTION, by R.B. Jones, R.G. Diquattro, and R.G. Towle. Rept. on Contract AF 33 (616)2246. June 58, 112p. 8 refs. WADC Technical rept. 57-370; AD-155 846.
Order from OTS $2.75 PB 151 455

Utilizing principles previously established by the National Advisory Committee for Aeronautics and the Walter Kidde & Company, Inc., an aircraft crash-fire prevention system was designed, developed and flight tested. The object of the program was to demonstrate, through the use of pre-production type equipment, the feasibility of providing an airworthy and reliable aircraft crash-fire prevention system. A transport type airplane, the USAF C-119G, was used as test medium for the system. The system was designed to eliminate, in the event of a survivable type crash, the potentially dangerous crash-fire hazards usually found in an airplane. This was accomplished by providing for the inerting of all possible sources of ignition, as well as the shutoff of combustibles in pacelles and de-energizing of the airplane's electrical system. The system also included crash damage sensing devices coordinated by a control unit to automatically initiate the inerting and shutoff equipment on the event of crash. Circuitry for semi-automatic checkout of the system was incorporated in the control unit. The flight tests which concluded the program demonstrated that an aircraft crash-fire prevention system can be made airworthy and reliable.

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
BIOCIDES FOR A STRIPPABLE VINYL PLASTIC BARRIER MATERIALS by S.H. Ross. July 57, 26p. 15 refs. Rept. R-1396.
Order from OTS $0.75 PB 151 119

Object of the research was to investigate the effect of microbial attack on sprayable, strippable, vinyl plastic films, and to determine the effectiveness of several biocides in preventing changes in mechanical properties due to microbial attack.

Food

Quartermaster Field Evaluation Agency, Fort Lee, Va.
INVESTIGATION OF THE RELATIONSHIP BETWEEN GENERAL ATTITUDE TOWARD THE ARMY AND SPECIFIC FOOD ATTITUDES AND PREFERENCES, by Robert S. Andrews. June 58, 21p. 11 refs. Technical rept. R-1.
Order from LC mi $2.70, ph $4.80 PB 136 057

This is a report of an investigation conducted to explore the relationships of general attitude towards the Army and social status level to food preference ratings obtained from soldier consumers in field tests. The results indicate that attitude can be an important determinant of the level of food preference ratings and that social status may also be a factor; but in regard to the latter the results are not conclusive.

Southwest Research Inst., San Antonio, Tex.
DETECTION OF RADIATION INDUCED FREE RADICALS BY PARAMAGNETIC RESONANCE, by F.K. Truby, J.P. O'Meara, and T.M. Shaw. Rept. no. 16 (Final) for 18 May 55-18 Oct 57 on Contract DA 19-129-qm-378. Nov 57, 78p. 8 refs.
Order from OTS $2.00 PB 131 966

Electron paramagnetic resonance instrumentation has been developed for the detection of free radicals in irradiated foods. The developed equipment has been employed to detect free radicals formed in irradiated foods and to study the kinetics of the observed free radical reactions. It has been determined that most basic food constituents exhibit an electron resonance absorption pattern which is unique to that particular substance. Thus, the method offers a technique for the fingerprinting or identification of food constituent materials.

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

National Research Council, Washington, D.C.
SHIPBOARD CRANES AND BURTONING GEAR: EVALUATION OF CARGO HANDLING EQUIPMENT IN THE LIBERTY SHIP MODERNIZATION PROGRAM. Final rept. by the Maritime Cargo Transportation Conference. 15 June 58, 108p. 32 refs.
Order from OTS. $2.50 PB 121 920R

The conclusions stated below follow from the combined results of the controlled tests and the in-service examinations of the crane ship and the conventionally rigged ships. The relative cargo-handling efficiency of shipboard cranes and the conventional boom and winch equipment is determined by several independent variables. The more important of these are: (a) The physical characteristics of the commodities to be handled (unit size, shape and density), and (b) the methods used to handle the cargo on the apron and in the hold. This precludes a single statement as to the overall superiority of either type of gear. Advantageous results, probably not in excess of 15 percent with current hold configuration, may be expected with shipboard cranes in the loading and discharge of commodities falling within the "balanced" handling category (Category III). The degree of advantage depends upon the use of the crane's spotting ability to reduce manual horizontal movement in the hold. The rate of loading (tons per gang hour) with a given draft size can be improved by direct vertical positioning (e.g. container stowage in the square of the hatch). Little or no improvement over conventional equipment can be expected from the use of shipboard cranes in situations where cargo handling operations are drastically hold limited, or where there is little premium on spotting ability. Performance in these cases can be expected to be about equal with the two types of gear.

Engines and Propulsion Systems

Air Research and Development Command, Washington, D.C.
CONFERENCE ON ION AND PLASMA RESEARCH, 30 SEPTEMBER-20 OCTOBER 1958 [HELD] AT THE UNIVERSITY OF MARYLAND, COLLEGE PARK, MARYLAND. [1958] [76]p. 20 refs. AFOSR TR-58-125; AD-162 274.
Order from OTS $2.00 PB 151 316

Abstracts are given for papers which were presented on the following subjects: ion rocket studies, research chamber for experimental studies on ion propulsion, an electromagnetic accelerator and its applicability to acceleration of an electrical discharge plasma, plasma production by exploding wires, acceleration and channeling of plasma jets by magnetic fields, magnetohydrodynamics, Litton research on plasma acceleration, research in high intensity ionic jets, preliminary engineering evaluation of advanced propulsion systems and power sources, basic study of energy exchange progress between an electric arc and a gas flow, axisymmetric stagnant flow of a viscous and electrically conducting fluid near the blunt nose of a spinning body with the presence of a magnetic field, nonlinear hydromagnetic wave motion, kinetic equation for a plasma with unsteady correlations, charge removal in low-energy plasmas, a quasi-similarity solution of a composite radiation-hydrodynamic spherical shock, phenomena surrounding high-speed flight, a discussion of some recent work on electron collision cross sections, the study of plasmas through their interaction with high-frequency electromagnetic waves, energy spectrum of plasma electrons, progress and objectives of ARDC sponsored plasma, noise in gas discharges, research in plasmas and optical excitation cross sections in atomic cases, stability in a magnetic field, methods of heating and confining a thermonuclear plasma, plasma propulsion for space applications, the high intensity arc as a plasma propulsion source, development of a low temperature plasma jet, plasma heating research, an investigation of electron and ion beams under outer space conditions, positive-ion emission from surfaces, study of ionization in rocket flames, plasma generation and control, coherent microwave oscillations of a beam-plasma system, investigation of nonlinear phenomena associated with ionized plasmas, investigation of propagation phenomena in high temperature plasmas, plasma research at Stanford University, plasma program (PIB), plasma work (U. of Calif.), high-altitude voltage-breakdown investigation, statistical mechanics of many-body systems, tentative research program on gaseous electronics, hydromagnetic wall shielding, heat transfer, wave propagation and oscillation in plasma bodies, comprehensive theory on plasma states and phenomena, heat transfer in ionized gas streams, the effect of the environmental flow field on the convective and radiative heat transfer from gas-stabilized arc columns, basic concepts of plasma state, wave propagation and plasma motion, investigation of factors affecting microwave breakdown and transmission near missile antennas, electromagnetic scattering properties of a resonant plasma, electron beam scattering and oscillations in plasma, theoretical and experimental study of plasmoids, a review of the plasma research program in the physics department at Stevens Institute of Technology.

Bureau of Aeronautics, Navy Dept., Washington, D.C.
TURBO-JET AND TURBO-PROPELLER ENGINE CORRECTIONS FOR INLET DUCT AND TAILPIPE PRESSURE LOSSES, by Otis E. Lancaster. Feb 47, 19p. Rept. no. ADR-1021.
Order from LC mi $2.40, ph $3.30 PB 135 607

The correction method achieved herein is based upon the modified Joule cycle which is drawn on the entropy diagram as two polytropic lines between two isobars. Pressure losses through the system

increase the unavailable energy and therefore increase the entropy.

National Advisory Committee for Aeronautics, Washington, D.C.
EFFECT OF CHORD SIZE ON WEIGHT AND COOLING CHARACTERISTICS OF AIR-COOLED TURBINE BLADES, by Jack B. Esgar, Eugene F. Schum, and Arthur N. Curren. 1958. 15p. 11 refs. Supersedes TN-3923; AD-120 811.
Order from GPO* $0.20 NACA rept. 1354

This analysis shows that turbine blade weight is affected to a much smaller degree by the size of the blade chord for air-cooled blades than for solid uncooled blades. The heat-transfer analysis shows that considerable savings in coolant flow are possible by using a smaller number of large-chord blades rather than a larger number of small-chord blades (constant blade solidity). In addition to the high coolant flows, the small-chord blades are often unable to pass the required flow at the pressure levels encountered in engine operation.

National Bureau of Standards [Washington, D.C.]
METHANE-OXYGEN-FLUORINE FLAMES SPECTROSCOPIC AND CALORIMETRIC STUDIES, by J.J. Ball, D.E. Mann and others. Final technical rept. on Liquid Rocket Propellants, Contract AF 33(616)56-20. Oct 58, 69p. 25 refs. WADC Technical rept. 58-541; AD-204 802.
Order from OTS $1.75 PB 151 505

Flame spectra for methane burning in mixtures of fluorine and oxygen are reported for the following mixtures: $CH_4+[2\ (1-x)O_2+xF_2]$, $CH_4+[2\ (1-x)O_2+2xF_2]$, $CH_4+[1.5\ (1-x)O_2+xF_2]$, and $CH_4+[1.5\ (1-x)O_2+2xF_2]$, with x = 0, 0.15, 0.25, 0.35, 0.50, and 0.60. The spectra observed are discussed from the point of view of changes produced in normal methane-oxygen flame spectra by the presence of fluorine. Oxygen appears to have an inhibiting effect upon C-F bond formation. Rotational temperatures of the OH(0, 0) band measured by the iso-intensity method gave values of 2900 ±200 and 3500 ±200°K respectively with $CH_4/O_2/F_2$ in molar ratios of 1/2/0 and 1/1/1. Heat measurements are reported for methane-flourine-oxygen flames with F_2/O_2 molar ratios of 4:1 and 3:2 and methane in proportions ranging from 0.65 to 1.85. The heat of combustion is approximately linearly dependent upon the CH_4/F_2 ratio in this range, and could be calculated with an accuracy of 1 to 2 percent from the observed proportions of combustion products CF_4, COF_2, CO_2, CO and HF. COF_2 is a principal product, amounting to 30 to 60 per cent in some flames. The heat of formation of COF_2 is discussed.

Perkin-Elmer Corp, Norwalk, Conn.
DEVELOPMENT OF AN EXPERIMENTAL GAS RADIATION PYROMETER, by Gordon W. Dueker and Eugene L. Woodcock. Final engineering rept. for 1 July 55 - 30 June 56 on Temperature Sensing Systems, Contract AF 33(600)30130. July 57, 62p. Rept. 5021; WADC TR-56-360; AD-110 719.
Order from OTS $1.75 PB 151 031

Investigation was made of methods of gas radiation pyrometry which are applicable to the measurement of the extreme temperatures of combustion gases in jet engines. Particular consideration was given to development of an instrument which could measure the extreme temperatures and be able to withstand engine skin temperatures of 1000°F. In this regard, materials for the construction of a detector cell including thermopile detector, windows, and lead seals were investigated; selective detectors utilizing the absorption of CO_2 and other types of filters were built and tested; total radiation type detectors were considered, and the use of thermistors and resistance wire elements as sensors were investigated.

Princeton U., N.J.
COMBUSTION PROCESSES IN LIQUID PROPELLANT ROCKET MOTORS, by I.E. Smith and I. Glassman. Quarterly progress rept. no. 6, 1 Jan-31 Mar 57, on Contract AF 18(600)1527. 1 June 57, 14p. 4 refs. Aeronautical Engineering rept. no. 334-f.
Order from LC mi $2.40, ph $3.30 PB 136 091

More extensive results on the ethylene oxide decomposition reaction at high temperatures have been accumulated with the new flow-type reactor. In the range of 1660 to 2000°R, the activation energy of the decomposition reaction was found to be about 42 kcal/mole, a value which is lower than that reported for the low temperature decomposition process. Experiments have shown that the concentration of injected fuel and the velocity of the inert carrier gas had no significant effect in the apparatus and the reaction follows overall-first-order kinetics. Various parts of the equipment for the construction of the high pressure apparatus have been received during this period.

Sundstrand Turbo Div., Sundstrand Machine Tool Co., Pacoima, Calif.
STUDY OF HIGH ENERGY LEVEL, LOW POWER OUTPUT TURBINES, by D.H. Silvern and O.E. Balje. Rept. for 1 Feb-31 Dec 57 on Contract Nonr-2292(00). 9 Apr 58, 183p. 27 refs. AFM/TD no. 1196; AD-161 323.
Order from LC mi $8.40, ph $28.80 PB 136 296

The aim of this program was to appraise the potential of axial and terry turbines as well as drag turbines by investigating the maximum obtainable efficiency of these turbine types as function of significant design parameters and to obtain detailed design criteria for the optimum design, such as blade and channel geometries. This report deals with the turbine performance range and other criteria (stall torques, runaway speed) of the investigated turbines types. The conclusions presented are

*Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

considered final for single stage axial turbines, but are of preliminary nature and subject to revisions for all other types due to the limited amount of experimental data, particularly on component performance, such as losses in terry buckets, influence of exhaust port configuration on performance of axial and terry turbines and influence of channel and blade geometry on drag coefficients for drag turbines.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
FIRE-EXTINGUISHING STUDIES OF THE NORTHROP F-89 POWERPLANT, by Allen V. Young. Oct 58, 25p. Technical Development rept. no. 365.
Order from OTS $0.75 PB 151 357

A study was made of the control of in-flight turbojet powerplant fires by conducting full-scale tests on the F-89 fire-extinguishing system. The early phases of this study showed that the F-89 fire-extinguishing system was ineffective in extinguishing fires of low, as well as high, intensity. Seven modifications of this system were tested in an effort to accomplish successful extinguishment using bromochloromethane in a perforated tubing system. Considerable improvement in extinguishment of fires was accomplished but not sufficient to warrant acceptance of the system. A high-rate discharge system then was considered as a possible means of providing effective extinguishment. A high-rate-discharge system, consisting of a manifold and distribution lines, was developed which effectively extinguished all fires ignited inside the engine bay, including those of a size which consumed all oxygen in the cooling air. Dibromodifluoromethane was found more effective than bromochloromethane as the extinguishing agent.

Machine Parts and Mechanisms

Crucible Steel Co. of America, Pittsburgh, Pa.
A STUDY OF THE METALLURGICAL PROPERTIES THAT ARE NECESSARY FOR SATISFACTORY BEARING PERFORMANCE AND THE DEVELOPMENT OF IMPROVED BEARING ALLOYS FOR SERVICE UP TO 1000 F, by T. V. Philip, A. E. Nehrenberg, and G. Steven. Rept. for 1 Apr 57-31 Mar 58 on Metallic Materials, Contract AF 33(616)3318. Oct 58, 56p. WADC Technical rept. 57-343, pt. 2; AD-203 524.
Order from OTS $1.75 PB 151 415

To develop a bearing steel for operating temperatures up to 1000 F, fifty-one experimental compositions were studied. This report describes the theoretical considerations which formed the basis of the formulation of these steels as well as the annealing cycle, austenitizing temperature survey, and the tempering survey. The results of the tempering studies are plotted as "master tempering curves." As a result of tests, a steel of the following composition is recommended for use as a bearing steel for operating temperatures up to 1000 F:

C	Cr	V	W	Mo	Co
1.09	4.2	1.9	6.7	3.7	5.2

The steel should be heat-treated as follows: austenitize at 2225 F, oil quench, and temper for two consecutive 2-hour periods at 1050 F. This work has not only developed a steel for elevated-temperature bearing applications but it has also clarified th the effects of alloying elements on secondary hardness, hardness retention at elevated temperatures, and other properties desired of a high-temperature bearing steel.

Rensselaer Polytechnic Inst., Troy, N.Y.
CONTINUED STUDIES OF FLUID FILM WHIRL, by John F. Lewis and Graham B. Fulton. Rept. on Research in Bearings, Contract AF 33(616) 5030. Nov 57, 26p. 3 refs. WADC Technical rept. 57-737; AD-155 775.
Order from OTS $0.75 PB 151 418

Tests were conducted on two flexible rotors to extend the range of the bearing parameters used in WADC TR 56-259 (PB 121 519) "A Further Investigation of Disturbances Due to Oil Films in Journal Bearings". Two different weight rotors of essentially the same critical speed were used. The results of this investigation, combined with the results presented in WADC TR 56-259, indicated that there is a combination of L(length)/D(diameter) ratio, viscosity, and clearance which will give a minimum whirl impending speed very near twice critical. As L(length)/D(diameter) and viscosity are decreased and clearance is increased, the whirl impending speed rises very sharply from the minimum value. As the bearing parameters vary in the opposite sense, the whirl impending speed increases very slowly. In a number of cases, the behavior varied greatly from that which was expected. These cases are herein reported separately and the reliability of the results is discussed. The "Characteristic curve" proposed in WADC TR 56-259 seems to be supported by the findings of this investigation. However, the peculiarities found preclude accurate definition of the curve at this time. Still unexplained is the large change in whirl impending speed with reversal of direction of rotation.

Manufacturing Equipment and Processes

Applied Mathematics and Statistics Lab., Stanford U., Calif.
MULTISTAGE INSPECTION SCHEMES, by Gerald J. Lieberman. Technical rept. no. 4 on Contract N6onr-251(26). 31 May 51, 22p. ATI-150 755.
Order from LC mi $2.70, ph $4.80 PB 136 297

This paper considers the problem of finding a multistage inspection scheme (a set of sampling plans which are applied to individual characteristics of items in a given lot at several stages in the production process) whose O.C. curve matches the O.C.

curve of a given (one stage) sampling plan regardless of the distribution of the proportion defective among the stages. Such a sampling procedure is as follows: At each stage, a random sample of n items is drawn from the lot. The lot is then accepted if (1) the number of defects at each stage does not exceed the acceptance number a and (2) the total number of defects in all the stages does not exceed a, and n are the acceptance number and the sample size respectively of the given (one stage) sampling plan that is being approximated.

Engineering Research Inst.,
U. of Michigan, Ann Arbor.
MACHINING TITANIUM, by O.W. Boston, R.M. Caddell and others. Final rept. on Contract [DA] 20-018-ORD-11918. June 55, 105p. Rept. no. 1993-16F.
Order from LC mi $5.70, ph $16.80 PB 136 426

Chapter I. Introduction
Chapter II. General properties of titanium
Chapter III. Common cutting properties
Chapter IV. Lathe operations
Chapter V. Milling
Chapter VI. Drilling
Chapter VII. Broaching
Chapter VIII. Shaping
Chapter IX. Tapping
Chapter X. Reaming
Chapter XI. Sawing
Chapter XII. Cutting fluids

General Mills, Inc., Minneapolis, Minn.
FINE PARTICLE TECHNOLOGY, by E.N. Kemler. May 53, 2 nos.
Order from LC.

Vol. 1. Patent survey of fine grinding technology, 297 p. mi $11.10, ph $45.60, PB 135 705

Vol. 2. Patent survey on separation and classification, 198p. mi $8.70, ph $30.30, PB 135 704

Springfield Armory, Mass.
PRELIMINARY INVESTIGATION OF A METHOD OF PREPARATION OF TITANIUM BASE ALLOYS FOR CHROMIUM PLATING, by G.L. Underhill. Jan 58, 29p. Rept. SA-TR19-1204.
Order from OTS $0.75 PB 151 044

Practicality of the use of a molten aluminum bath to alloy with the surface of titanium-base materials and produce an aluminum-titanium, aluminum-rich surface area or case was investigated. Effectiveness of aluminum-treated surfaces as a base material upon which to plate chromium was evaluated. Materials and experimental procedure are described.

Watertown Arsenal Labs., Mass.
EXPERIMENTAL STUDY OF TITANIUM WIRE-DRAWING FORCES, by Frank R. Larson. Technical rept. on Metals for Lightweight Construction. June 57, [55]p. 11 refs. WAL 401/277.
Order from LC mi $3.60, ph $9.30 PB 135 419

Effect of die angle, drawing speed, percent reduction of area, and lubrication upon the forces encountered in the wire drawing of titanium A55 and titanium alloy C110M. A method which allows for strain rate effects was developed enabling the calculation of ideal draw forces on tensile test results.

MATERIALS

Ceramics and Refractories

Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF REFRACTORY MATERIALS FOR SEAL AND BEARING APPLICATIONS IN AIRCRAFT ACCESSORY UNITS AND ROCKET MOTORS, by L. B. Sibley, C. M. Allen and others. Rept. for 1 Mar 57-28 Feb 58 on Ceramic and Cermet Materials, Contract AF 33(616)3995. Oct 58, 59p. 10 refs. WADC Technical rept. 58-299; AD-203 787.
Order from OTS $1.50 PB 151 483

A number of ceramic, cermet, and high-temperature alloy materials have been evaluated for corrosion resistance and for friction and wear behavior in an oxidizing atmosphere from 1000 to 1800 F. Rubbing-wear experiments were conducted at 200 feet per second sliding speed with about 20-psi load pressure usually applied to the contact surfaces. Several material combinations involving an alumina-chromium-molybdenum cermet, silcon carbide, alumina, and perhaps a titanium carbide-nickel-molybdenum cermet may be satisfactory for short-life rubbing-seal applications under these conditions. The applications of these materials are limited since they wear rapidly and exhibit erratic frictional behavior. Superficial surface cracking was observed on the wear surfaces of all specimens containing brittle ceramic phases except possibly silicon carbide. A wear-failure mechanism for refractory materials under sliding contact is postulated, and some correlation of the experimental results with conventional thermal-stress-resistance parameters is obtained. Two rubbing-wear experiments were conducted in a high-temperature reducing atmosphere. The static corrosion resistance of several potential bearing and seal materials was determined in a nitric acid oxidizer used in some rocket-propellant pumps. Experimental ceramic and cermet materials were fabricated, and some of these specimens were evaluated in rubbing-wear experiments in the oxidizing atmosphere to study certain material-property effects on friction and wear behavior.

Federal Telecommunication Labs. Nutley, N. J.
RESEARCH ON GROWING SINGLE CRYSTALS OF CERAMIC MATERIALS WITH FERRIMAGNETIC PROPERTIES, by A. J. Marino, Jr. Scientific rept. no. 4, 1 Jan - 31 Mar 58, on Contract AF 19(604)-2261. Apr 58, 29 p. AFCRC TN-58-133; AD-146-894.
Order from LC mi$2.70, ph$4.80 PB 135 874

The crystals grown were of manganese ($MnFe_2O_4$) and cobalt-substituted manganese ferrite types. In growing crystals with r-f and annealings, the radical cracking common to the tri-cone method has been eliminated. A new phenomena is now observed which is similar to Widmanstättern. Crystals have been grown to 1/2 inch diameter by 1 inch long.

Firth Sterling, Inc. [Pittsburgh, Pa.]
INVESTIGATION OF THE FEASIBILITY OF PRODUCING METAL BONDED CARBIDE BODIES BY THE EXTRUSION PROCESS, by William W. Wellborn. Rept. for July 52 - May 55 on Ceramic and Cermet Materials, Contract AF 33(616)229. Dec 55, 39p. WADC Technical rept. 55-327; AD-93 170.
Order from LC mi$3.00, ph$6.30 PB 136 766

Extrusion metal-bonded titanium carbides was found possible using a 1050-ton extrusion press into simple shapes. The comparison of properties of objects produced by extrusion, with those of the same composition produced by pressing, shaping, and sintering revealed that the physical properties of extruded material were found to be measurably lower than materials compacted by conventional means.

Illinois U., Urbana.
METAL BONDED ZIRCONIUM DIBORIDE, by George Don McTaggart, Tracy A. Willmore and Dwight G. Bennett. Rept. on Contract W33-038-ac-14520. June 54, 48p. 17 refs. WADC Technical rept. 54-194; AD-45 691.
Order from LC mi$3.30, ph$7.80 PB 136 694

Zirconium diboride powders from two producers were combined with 20% by weight of either cobalt, chromium, nickel, or a mixture of cobalt plus chromium. Compacts and bars were formed using the techniques of powder metallurgy. A discussion of the phases present before and after firing, as determined by X-ray techniques, is presented. Modulus of rupture determinations and tests for oxidation resistance at 2000°F were made. The mixtures tested have only moderate strength and their oxidation resistance was too low for use at 2000°F in oxidizing atmospheres.

New York State Coll. of Ceramics, Alfred U.
METAL AND SELF-BONDED SILICON CARBIDE. PART II, by R. E. Wilson, L. B. Coffin, and J. R. Tinklepaugh. Rept. for 11 Jan - 29 Dec 54 on Contract AF 33(038)16190. Jan 55, 47p. WADC TR-54-38, pt. 2; AD-63 615.
Order from OTS $1.25 PB 151 115

In the formation of dense self-bonded silicon carbide by hot pressing, the presence of aluminum in small quantities was found essential to the formation of uniformly dense specimens. Modulus of rupture strengths was found to increase with temperatures, achieving 69,000 psi at 2500°F. Molybdenum and silicon carbide was hot pressed to form dense specimens having good oxidation resistance and having modulus of rupture exceeding 70,000 psi at 1800°F. Effects of the partial replacement of titanium carbide by silicon carbide in a sintered titanium carbide-nickel cermet are described. Infiltration of nickel into silicon carbide and titanium carbide-silicon carbide skeletons was studied. (See also PB 130 472 and PB 121 353)

Ohio State U. Research Foundation, Columbus
CERAMIC-FIBER BASE CERMETS, by Louis J. Trostel, Jr., Earle T. Montgomery, and Thomas S. Shevlin. Rept. on Ceramic and Cermet Research, Contract AF 33(616)472. Mar 54, 24p. 8 refs. WADC TR-54-172, pt. 1.
Order from LC mi$2.70, ph$4.80 PB 135 379

Cermets composed of ceramic oxide fibers and powdered metal mixtures are described. Vibrational forming techniques were found most suitable for preparation of specimens. Materials tested included fibrous alumina-silicate bonded by 71.4 to 91.0 weight per cent of stainless steel powders.

Southern Research Inst. [Birmingham, Ala.]
MEASUREMENT OF SOME THERMAL PROPERTIES OF THREE GLASSES, by John V. Melonas, Perry C. Covington, and Coultas D. Pears. Rept. for May 57 - Jan 58 on Rubber, Plastic and Composite Materials, Contract AF 33(616)5264. Aug 58, 20p. WADC Technical rept. 58-129; AD-155 816.
Order from OTS $0.50 PB 151 419

The thermal conductivity and heat capacity were determined for the following 3 glass materials: (1) soda-lime silica (Libbey-Owen-Ford 9330), (2) borosilicate (Pittsburgh Plate Glass 3235), and (3) alumina-silicate glass (Corning Glass Works 1723). This investigation covered the temperature range from -100°F to the strain point of the material.

Fuels, Lubricants, and Hydraulic Fluids

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PHYSICAL PROPERTIES OF JP-4 FUELS AND DEVELOPMENT OF EQUATIONS FOR PREDICTING FUEL SYSTEM PERFORMANCE UNDER TWO-PHASE FLOW CONDITIONS, by J. Kelly Gladden, Mario J. Goglia, and Henderson C. Ward. Rept. on Fuel and Propellant Sub-Systems, Contract AF 33(616)2660. Nov 55, 173p. 28 refs. WADC Technical rept. 55-422, pt. 2; AD-106-311.
Order from LC mi$8.10, ph$27.30 PB 137 123

The physical properties of JP-4 fuels that are considered most important for the study of two-phase fuel flow in aircraft fuel systems are presented in Section I. An attempt is made to estimate the numerical values of these physical properties and to give their variation with pressure, temperature, and volume. An effort is also made to estimate the spread to be expected in the values of certain of these physical properties and, in some cases, to assign an average value.
The development of equations for predicting fuel system performance under two-phase flow conditions is presented in Section II. Application of these equations yields a recommended procedure for calculating the pressure drop under such conditions. The properties of JP-4 fuel from Section I are employed in the calculations to illustrate the performance of a typical aircraft fuel system in steady flight and in a normal climb to altitude.

Horizons, Inc., Cleveland, Ohio.
A RESEARCH PROGRAM ON THE INVESTIGATION OF SEAL MATERIALS FOR HIGH TEMPERATURE APPLICATION, by Raymond H. Baskey. Rept. for 1 Jan 57 - 31 Mar 58 on Ceramic and Cermet Materials, Contract AF 33(616)3891. June 58, 74p. 12 refs. WADC Technical rept. 58-181; AD-155-689.
Order from OTS $2.00 PB 151 451

Novel rotating seal materials for potential aircraft applications at high speed and high temperatures were developed and tested under conditions of no external lubrication. Tests were conducted to determine the benefit derived from additions of nickel or silver to the refractory hard metals. The nickel acts as a tough, oxidation-resistant matrix. The silver was added to act as a lubricant as it softens at high temperatures. Two ternary alloys prepared by powder metallurgy techniques and consisting of high percentages by weight of a refractory hard metal, with nickel and silver additions, show superior wear qualities when run against either tool steel or Inconel. The best alloys contained either tungsten boride (WB) or chromium nitride (CrN) as the hard refractory metal. The WB alloy exhibited a constant wear rate at all temperatures against tool steel. The wear rate of the CrN alloy decreased at the higher temperatures. The finest wear performance was attained when Kentanium K162B ran against Kentanium K162B at sliding speeds of 14,000 fpm in an ambient temperature of 1100°F. The wear process is drastically influenced by the oxidation occuring on the rubbing surfaces and with proper choice of materials, stable, complex oxides are formed which provide the correct solid lubricating film on each component and markedly lower the wear rate as the temperature is increased.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EFFECT OF METALS ON LUBRICANTS, by John B. Christian. Rept. on Hydraulic Fluids. May 58, 23p. WADC Technical Rept. 54-576, Part 3; AD- 155 518.
Order from OTS $1.00 PB 151 446

The effects which an ester and a disiloxane have on various metals were studied as well as the effects which those metals simultaneously have on the fluids at 550°F. Oxidation-corrosion tests were conducted which involved refluxing one of the metal specimens and 100 g of the test fluid for 24 hr at 550°F. Air was allowed to bubble through the fluid at a rate of 5 l/hr. After the test, the metal specimen was observed for weight change, discoloration, corrosion, and etching or pitting. The fluid was tested for evaporation and change in appearance, neutralization number, and viscosity. Results indicated that MLO 8200, a siloxane, and all of the metals were compatible at 550°F. Bronze, Cu, and Mg were attacked

by the fluid. A 1 and brass caused excessive evaporation. Only in the presence of Al was there an extremely high acid number. MLO 57-565, an ester, was incompatible with all the metals. One-third of the metals evaluated were etched, pitted, or completely consumed. Change in neutralization number was excessive in the presence of each metal. Changes in viscosity ranged from + 33.75% to 107.97%.

National Advisory Committe for Aeronautics, Washington, D.C.
GRAPHS OF REDUCED VARIABLES FOR COMPUTING HISTORIES OF VAPORIZING FUEL DROPS, AND DROP HISTORIES UNDER PRESSURE, by G. L. Borman, M. M. El Wakil, and others. (U. of Wisconsin). Sep 58, 55p.
Order from NASA* NACA TN-4338

The two objectives of this investigation were: (1) To obtain experimental data for single droplets vaporizing at pressures greater than 1 atmosphere and to compare these data with theoretical predictions; (2) to evolv a simplified calculation technique to obtain droplet histories easily. Steady-state temperatures of hexane, decane, and hexadecane obtained experimentally for various temperatures and pressures from 1 to 5 atmospheres agreed to within + 10^{o} R with calculated values. A method of using reduced-variable graphs and nomograms is explained, and data to calculate histories of n-decane are presented.

Naval Powder Factory, Indian Head, Md.
EFFECTS OF GAMMA RADIATION ON NITROCELLULOSE, by Hyman Rosenwasser and C. L. Whitman. 28 Jan 57, 11p. 4 refs. Memo. rept. no. 128.
Order from LC mi$2.40, ph$3.30 PB 136 130

Samples from 2 lots of uncolloided nitrocellulose were subjected to total integrated doses of 1, 3, 5, 7, 9, and 11 million roentgens. Results of subsequent nitrogen determinations showed a slight decrease in nitrogen content as dosage increased. Bond rupture of the nitrocellulose is proposed as the major cause of the corresponding decrease in viscosity.

Picatinny Arsenal, Dover, N.J.
PROCESSING THE RAYONIER PATS-J AND INTERNATIONAL TENACELL SULFATE WOOD PULPS FOR THE NITROCELLULOSE FOR M7 PROPELLANT, by D. H. Chorlian. Sep 57, 26p. 3 refs. Rept. no. DB-TR:12-57.
Order from LC mi$2.70, ph$4.80 PB 135 322

Processing and product characteristics were determined of two experimental 3/8-Inch Stick M7 propellant lots: one containing nitrated Rayonier PATS-J Prehydrolyzed Sulfate Wood Pulp; the other, nitrated Tenacell Prehydrolyzed Sulfate Wood Pulp.

Rock Island Arsenal Lab., Ill.
DEVELOPMENT OF A HIGH DENSITY RECOIL OIL, by H. C. Muffley. Mar 58, 19p. Rept. no. 58-516.
Order from LC mi$2.40, ph$3.30 PB 135 432

The properties of 12 fluids were examined for possible use as high density fluids as prescribed by a proposed specification. These fluids included such type compounds as halogenated hydrocarbon, halogenated cyclic compound, phosphate, silicone, halogenated silicon, glycol ether and petroleum base fluid.

Samuel Feltman Ammunition Labs., Picatinny Arsenal, Dover, N.J.
PRELIMINARY EVALUATION OF CURRENT STABILITY TESTS WITH AN ESTIMATION OF SAFE LIFE OF PROPELLANTS, by Charles Lenchitz and Norman Beach. Sep 56, 41p. 13 refs. Technical rept. 2348.
Order from LC mi$3.30, ph$7.80 PB 135 434

A preliminary study of the standard stability and surveillance tests has been made for single-base propellants IMR 5065, M1, M6, and M10.

White Sands Proving Ground, N. Mex.
CORPORAL AND NIKE-AJAX. EVALUATION OF CORPORAL AND NIKE-AJAX PROPELLANTS AND PROPELLANT CONTAINERS WITH REGARD TO STORAGE. PART V, by Raymond Strom. Rept. for Mar 57-Feb 58 on General Test Plan no. 3, Apr 58, 29p. Technical memo. 523.
Order from LC mi$2.70, ph$4.80 PB 136 186

Leather and Textiles

Lowell Technological Inst. Research Foundation [Mass.]
EVALUATION OF FUNGICIDAL VINYL COATED COTTON DUCK, by Jacob K. Frederick, Jr., Robert E. Otto, and David H. Pfister. Rept. for Jan 54 - June 58 on Finishes and Materials Preservation, Contract AF 33(616)3929. June 58, 58p. Rept. 29273; WADC Technical rept. 57-366; AD-155 686
Order from OTS $1.50 PB 151 464

This investigation was concerned with determining the effect of shelf storage or outdoor exposure for periods of four, six, ten, and twelve months followed by soil burial for two weeks upon the breaking and tearing strengths, low temperature flexibility, gasoline resistance, hydrostatic pressure resistance, weathering resistance, high temperature blocking, and color of 8.0 ounce vinyl coated cotton duck containing in the fabric or in the coating various fungicides. In addition to the

*National Aeronautics and Space Administration, 1520 H Street, N.W., Washington 25, D.C.

fungicides, some of the fabrics contained a stabilizer designed to prevent light deterioration. The exposure sites were in Alaska, Florida, New Mexico, and Ohio. The fungicides utilized in these studies were copper hydroxynaphthenate (CuOHNaph), copper 8-quinolinolate (Cu-8-Q), dehydroabietylammonium-pentachlorophenoxide (DAAP), dodecyldimethy-benzyl-ammonium-cyclopehtane-carboxylate (DDBACC), and dihydroxy-dichloro-diphenylmethane (3DM). The factors of breaking and tearing strength were considered to be of primary importance, while the others were considered as of secondary importance.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
STUDY OF THE EFFECT OF TEMPERATURE ON A PARACHUTE TEXTILE MATERIALS, by James W. Muse, Jr. July 58, 49p. 1 ref. WADC Technical rept. 54-117; AD-55 667.
Order from LC mi$3.30, ph$7.80 PB 136 765

The primary purpose of this investigation was to obtain data on the effect of oxygen, nitrogen, and compressed air on nylon and Dacron materials at various temperatures. A secondary purpose was to determine the effect of hot air, applied continuously and in an intermittent manner to parachute textile materials. The test method is described in the text of this report.

Textile Research Inst., Princeton, N. J.
MEASUREMENTS OF THE MECHANICAL PROPERTIES OF FEATHER AND DOWN FIBERS, by Joseph H. Dusenbury, Chang-Ning Wu, and Cornelia J. Dansizer. Final rept. for 2 May 55-1 Aug 57 on Contract DA 19-129-qm-001. June 58, 57p. 18 refs.
Order from LC mi$3.60, ph$9.30 PB 135 854

The elastic moduli of European goose feather barbs and down filaments have been measured at 70°F and at 65% R.H. and various pressures of dry-air. With the Vacuum Vibroscope which was designed and constructed to facilitate these measurements, it is possible to carry them out in a vacuum or in controlled atmospheres, e.g., constant relative humidity. Design drawings of this Vacuum Vibroscope have been submitted. A brief description of the operation of the Vacuum Viroscope is given herein. Measurements have also been made of the mechanical properties of vane and fluff barbs taken from chicken feathers given several different resin treatments.

Textile Research Inst., Princeton, N.J.
THERMAL CHARACTERISTICS OF COATED TEXTILE FABRICS, by Irvin M. Gottlieb, Sandra Glassman and others. Summary rept. 23 Apr 56-22 Apr 57, on Contract N140(132)57442B. 15 July 57, 114 p. 21 refs.
Order from LC mi$6.00, ph$18.30 PB 136 154

On the basis of the research reported here, it is conculed that the method of analysis used (loss in weight) is sufficiently sensitive to separate the effects of the various coating types on the thermal behavior of textile fabrics. It was found that the coating improved the stability of the cotton fabrics at high temperatures. On the other hand, coated nylon was less stable at temperatures below 900°F than the uncoated nylon fabric. Of greater importance, however, is the fact that coatings help the nylon to retain its fabric structure. Uncoated nylon fabric loses its structure at these high temperatures.

Paints and Finishes

Army Engineer Research and Development Labs., Fort Belvoir, Va.
VINYL-LACQUER COATING FOR INTERIOR OF MILITARY STEEL PIPELINE TUBING, by Sanford J. Holzsweig. May 57, 36p.
Order from OTS $1.00 PB 151 013

The suitability was investigated of a vinyl lacquer for coating the interior of military steel pipeline tubing used for handling petroleum products. The vinyl-lacquer coating protects the interior of the tubing from atmospheric corrosion during storage, providing the tubing with a smooth interior of low friction factor free from the necessity of periodic cleaning with a brush-type pipeline cleaner after use. Tests were made to determine the effect of the vinyl-lacquer coating on the gum content of fuel, and the pipeline pressure loss. Vinyl-lacquer-coated tubing sections were exposed to motor gasoline, aviation gasoline, JP-4 jet fuel, tap water, and 5% salt water for one year while other sections were exposed to the atmospher for two years. After exposure the interior of the tubing was examined for corrosion and necessity of cleaning. The report concludes that: a. The vinyl-lacquer coating will protect the interior of steel tubing from atmospheric corrosion during storage; b. the vinyl-lacquer coating will eliminate the need for cleaning pipelines with a brush-type cleaner; c. a vinyl-lacquer-coated pipeline will not have a lower line pressure loss than a clean, bare-steel pipeline; d. a vinyl-lacquer-coated pipeline will accelerate the formation of gum in fuels at a much higher rate than an uncoated steel pipeline; and e. vinyl-lacquer coating would not be satisfactory where wrinkle type field bending or field welding of tubing or pipe is required.

Fansteel Metallurgical Corp., North Chicago, Ill.
DEVELOPMENT OF A PROTECTIVE COATING FOR TITANIUM ALLOYS, by Stanley Kluz, Caesar Kalinowski, and Ralph Wehrmann. Interim technical progress rept. 29 Feb - 30 June 52 on Contract DA11-022-ORD-230. 25 July 52, 5p. Rept. no. 401/51-11.
Order from LC mi$1.80, ph$1.80 PB 136 716

A large number of coated titanium strips were prepared by sintering in a helium atmosphere. Several of these were tested in air at 800°C.

Fansteel Metallurgical Corp., North Chicago, Ill.
STUDY AND RESEARCH OF THE SILICONIZING OF TITANIUM, by Stanley Kluz, Caesar Kalinowski, and Ralph Wehrmann. Interim technical progress rept. for 1 July - 31 Dec 52 on Contract DA11-022-ORD-1069; Continuation of Contract DA11-022-ORD-230. 21p. Rept. no. 401/51-18.
Order from LC mi$2.70, ph$4.80 PB 136 715

Silicon coatings affording protection to titanium for 1500 hours at 800°C in air have been prepared by the paint and sinter method.

Fansteel Metallurgical Corp., North Chicago, Ill.
STUDY AND RESEARCH OF THE SILICONIZING OF TITANIUM, by Stanley Kluz, Caesar Kalinowski, and Ralph Wehrmann. Final technical rept. 1 July 52 - 31 May 54 on Contract DA11-022-ORD-1069; Continuation of Contract DA11-022-ORD-230. 24p. Rept. no. 401/51-22.
Order from LC mi$2.70, ph$4.80 PB 136 714

Four methods of applying silicon coatings were investigated; paint and sinter, vapor phase deposition, flame spray, and cementation. The best results were obtained by sintering in vacuum. The coatings were tested for resistance to oxidation by a combination visual examination, weight change, and thermal shock method. Pellets, bars, and crucibles of Ti_5Si_3 were prepared by powder metallurgy and physical properties determined.

Frankford Arsenal, Philadelphia, Pa.
SALT SPRAY TESTING OF PAINTED SURFACES OF AMMUNITION BOXES, by W. J. Rose, Dec 56, 29p. (11 color photos will not reproduce) Memo. for record no. 1733; Small Arms Ammunition Development Branch rept. no. 13.
Order from LC mi$2.70, ph$4.80 PB 135 117

Ammunition boxes and panels from ammunition boxes were subjected to a 5% by weight salt spray solution and a standard 20% by weight salt spray solution to compare the corrosive effects of the two salt spray concentrations. The 5% by weight salt spray is a more corrosive atmosphere to phosphate coated and painted ammunition boxes than a 20% by weight salt spray. The apparent correlation between the two salt spray concentrations is that the 5% solution will produce the same amount of corrosion in approximately one half the time as the 20% solution.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
CONDUCTIVITY TESTING OF ZINC DUST PIGMENTED COATINGS, by D. S. Nantz. Rept. for June 56-Jan 57. Sep 57, 36p. WADC TR-57-185; AD-131 054.
Order from OTS $0.75 PB 131 435

Several procedures were tried before a good conductivity test was developed. These conductivity test can be then used as a scientific basis for formulation of zinc rich coatings which will provide good galvanic protection to steel. It was concluded that the conductivity test developed can be used to determine optimum zinc concentration, film thickness, and drying time for any given vehicle pigmented with zinc.

Plastics

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
NEW SPOT TEST FOR EPOXY RESINS, by M. H. Swann. June 58, 5p. CCL #57.
Order from OTS $0.50 PB 151 032

A new, rapid "spot" test for bisphenol-type epoxy resins is described that will be very useful in routine identification of synthetic resins in coating materials. Although this test is not the first available for the purpose, it is specific and exceptionally rapid and simple to conduct. It is applicable to all types of coating materials, including dried or cured films. A unique feature of this "spot" test is that no reagent is employed, other than the cellulose of the filter paper on which the test is observed.

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
RAPID IDENTIFICATION OF DICARBOXYLIC ACIDS IN ALKYD RESINS AND POLYESTERS, by G. G. Esposito. July 58, 16p. 10 refs. CCL # 59.
Order from OTS $0.50 PB 151 033

The object of this investigation was development of a rapid technique for identifying the eleven dicarboxylic acids commonly used in manufacturing alkyd resins, polyesters and plasticizers. Microscopic examination of crystals of the free acids formed by hydrolysis of their dipotassium salts shows distinct characteristics, which, with one exception, can be used to obtain rapid identification of each of these acids in coating materials.

Kawneer Co.; Niles, Mich.
DEVELOPMENT OF IMPROVED SHELTER PANELS FOR ARCTIC SERVICE, by B. L. Waterhouse. Final engineering rept. Mar 56-May 57 on Contract AF 30(602)1521. 131p. RADC TR-57-109; AD-131 155.
Order from LC mi$6.90, ph$21.30 PB 136 692

This report includes the engineering services, selection of materials, and investigations necessary to design, develop, and fabricate improved shelter panels utilizing foam-in-place resins as core materials.

Samuel Feltman Ammunition Labs., Picatinny Arsenal, Dover, N.J.
EFFECT OF PETROLEUM BASE FUELS AND OILS ON THREE NYLON PLASTICS, by Roman W. Kuchkuda. Apr 57, 150p. Technical rept. 2403.
Order from LC mi$7.20, ph$22.80 PB 135 515

Three nylon molding compositions were stored in contact with various fuels and oils at ambient and elevated temperatures. Mechanical properties of these plastics were determined before and after storage. Nylon FM10001 and Nylon FM6501 are essentially unaffected by the oils and fuels tested. When stored for long periods in contact with the lubricating oils used in this program Nylon FM6503 was distorted beyond use.

Rubber and Elastomers

Rock Island Arsenal Lab., Ill.
BRITTLENESS TESTING OF ELASTOMERIC VULCANIZATES, by Robert E. Ofner, June 58, 28p. 8 refs. Rept. no. 58-1262.
Order from OTS $0.75 PB 151 043

Investigations pertaining to brittleness tests for rubber, undertaken by the RIA Laboratory during the period 1948 to 1958, are presented in chronological order.

Rock Island Arsenal Lab., Ill.
EVALUATION OF ANTICRYSTALLIZING NATURAL RUBBER, by James D. Ruby. Feb 58, 17p. Rept. no. 58-301.
Order from OTS $0.50 PB 151 011

Anticrystallizing natural rubber, prepared by modifying natural rubber with an organic thiol acid, was made available to the Rock Island Arsenal Laboratory by the British Ministry of Supply. Evaluation of vulcanizates based on this modified natural rubber indicated that they differ from unmodified natural rubber in original stress-strain properties and have poorer property retention after aging. Anticrystallizing rubber and unmodified natural rubber display essentially the same properties at low temperature, with the exception of elastic recovery, in which respect the anticrystallizing rubber is superior. Results indicate that thiol acid modified natural rubber is much more resistant to crystallization than is the unmodified natural rubber.

MATHEMATICS

Antenna Lab., Ohio State U. Research Foundation, Columbus.
ADDITIONAL TABLES OF ASSOCIATED LEGENDRE FUNCTIONS, by Yasuto Mushiake and Howard Baeumler. Rept. on Contract DA 36-039-sc-70174. 15 Apr 57, 26p. 2 refs. Rept. 662-4.
Order from LC mi$2.70, ph$4.80 PB 137 654

The National Bureau of Standards Tables give $P_n^m(\cos\Theta)$ and $d/d\Theta\ P_n^m(\cos\Theta)$ for $\Theta = 0^o\ (1^o)\ 90^o$; $n = 1(1)\ 10$; $m = 0(1)4$. The present tables extend the NBS tables by giving $P_n^m(\cos\Theta)$ and $d/d\Theta\ P_n^m(\cos\Theta)$ for $\Theta = 0^o\ (1^o)\ 90^o$; $n = 1(1)10$; $m = 5(1)10$.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THE FUNDAMENTAL SOLUTION MATRIX FOR SYSTEMS OF LINEAR PARTIAL DIFFERENTIAL EQUATIONS, by Gordon Latta and James McGregor. Rept. on Theoretical Study of Acoustic Energy, Generation, Propagation and Reception, Contract AF 33(616)2987. Aug 58, 24p. 4 refs. WADC Technical rept. 58-416; AD-155 824.
Order from OTS $0.75 PB 151 452

The construction of the fundamental solution matrix for systems of linear partial differential equations with real analytic coefficients is shown to depend on the fundamental solutions of a number of scalar equations, the connection being purely algebraic. The given differential operator matrix A is diagonalized by the operation AB = D, where B, D are differential operator matrices with real analytic coefficients, and D is diagonal.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
VARIATIONAL METHODS IN CONFORMAL MAPPING WITH APPLICATIONS TO HYDRODYNAMICS, by Peter W. Shaw. Rept. on Contract Nonr-225(11). Aug 57, 74p. 17 refs. Technical rept. no. 66.
Order from LC mi$4.50, ph$12.30 PB 135 894

This paper is divided into two parts. Part one deals with a problem in conformal mapping while part two treats a problem in hydrodynamics. Both problems are approached from the same point of view and are solved by variational methods which have appeared with increasing frequency in recent work in applied mathematics. In each case they will be transformed and reformulated as extremal problems in the calculus of variations. The extremal problems are of a similar nature, although the hydrodynamic one will be found to be far more difficult.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
TABLES FOR ONE-SIDED STATISTICAL TOLERANCE LIMITS, by Gerald J. Lieberman. Technical rept. no. 34 on Contract N6onr-251(26). 1 Nov 57, 23p. 6 refs. AD-148 179.
Order from LC mi$2.70, ph$4.80 PB 137 254

Applied Mathematics and Statistics Lab., Stanford U., Calif.
THEORY OF PSEUDOGROUPS WITH APPLICATIONS TO CONTACT STRUCTURES, by John W. Gray. Technical rept. no. 65 on Contract Nonr-225(11). 15 July 57, 97p. 32 refs.
Order from LC mi$5.40, ph$15.30 PB 136 109

Chapter 1. Pseudogroups and local structures: sheaves; fibre bundles; local structures: Bourbaki structures, induction laws, pseudogroups and topological groupoids, factor groupoids, local structures, induced maps, representations, examples; realizations and manifolds. Chapter 2. Contact Manifolds:

fundamental properties; almost-contact manifolds; the spaces F(2n) and F(2n+1) invariant contact forms. contact transformations.

California U., Berkeley.
EIGENFUNCTION EXPANSIONS FOR NON-SYMMETRIC PARTIAL DIFFERENTIAL OPERATORS, I, by Felix E. Browder. Technical rept. no. 15 on Contract Nonr-222(37). Oct 57, 29p. 28 refs.
Order from LC mi$2.70, ph$4.80 PB 136 281

Chicago U., Ill.
A PROOF OF THE SUBGROUP THEOREM FOR FREE PRODUCTS, by Saunders MacLane. Rept. on Research on Algebraic Mechanism of Fiber Spaces, Contract AF 18(600)1383. Jan 58, 12p. 9 refs. AFOSR TN-58-69; AD-148 112.
Order from LC mi$2.40, ph$3.30 PB 135 982

A steamlined version of an algebraic proof given by H. W. Kuhn (Ann. Math. 56:22-41, 1952) and A. J. Weir (Matematika 3:47-55, 1956) is presented for the following theorem: To any subgroup H of the free product $G = \ast_{\beta} A_{\beta}$ (A_{β} is a group for each index β in a set J), there is for each index $\beta \in J$ a set $\{S_{\beta}(D)\}$ of representatives of the H-A_{β} double cosets D such that H is the free product (of its subgroups) $H = F * [\ast_{\beta} (\ast_{D} (H \cap s A_{\beta} s^{-1}))]$, $s = S_{\beta}(D)$. F is a free group, β ranges over J, and for each β, D ranges over the H-A_{β} double cosets in G. If the index [G:H] is finite, the number of free generators of F is $1 - [G:H] + \Sigma([G:H] - m_{\beta})$, where m_{β} is the number of H-A_{β} double cosets in G.

Cornell U., Ithaca, N.Y.
THE PHRAGMEN-LINDELOF THEOREM AND SUBHARMONIC FUNCTIONS, by Hans Rademacher. Rept. no. 67 on Contract AF 18(600)685. Aug 57, 10p. AFOSR TN-57-457; AD-136 448.
Order from LC mi$1.80, ph$1.80 PB 135 989

The method used in the previous paper on the Phragmén-Lindelőf theorem (PB 135 990) is applied to some other boundary conditions. The prescribed growth functions in the resulting theorems form successive steps of a logarithmic scale. The existence theorem in this paper is treated by means of the Poisson formula.

Cornell U., Ithaca, N.Y.
A WIENER-HOPF EQUATION OF THE FIRST KIND, by Harry Pollard and Harold Widom. Rept. no. 74 on Contract AF 18(600)685. Dec 57, 9p. AFOSR TN-57-750; AD-136 738.
Order from LC mi$1.80, ph$1.80 PB 135 981

A solution is given of the Wiener-Hopf equation with kernal k, $f(x) = \int_0^{\infty} k(y)\,\phi(x+y)dy$, $x > 0$ under the assumptions that (1) $k \in L(0, \infty)$; (2) $k \not\equiv 0$ in the neighborhood of zero; (3) The Laplace transform $K(s) = \int_0^{\infty} e^{-sx} k(x)dx$ has no zeros in the closed right half-plane; and (4) $\phi \in L_p(0, \infty)$ for some p in $1 \leq p \leq 2$.

Electonics Research Lab., U. of California, Berkeley.
NOTE ON THE OPERATIONAL SOLUTION OF LINEAR DIFFERENCE EQUATIONS, by E. I. Jury and F. J. Mullin. Rept. on Contract AF 18(600) 1521. 14 Mar 58, 22p. 12 refs. Series no. 60, Issue no. 199; AFOSR TN-58-100; AD-148 149.
Order from LC mi$2.70, ph$4.80 PB 135 994

The z-transform is applied to the solution of linear difference equations with constant coefficients; boundary conditions are considered in the resulting solutions and certain theorems related to the z-transform are applied to obtain qualitative information about the solution. The z-transform is used to solve simultaneous difference equations with constant coefficients and the modified z-transform is used to solve difference equations whose coefficients are periodic functions. Finally the z-transform is applied to the solution of difference equations with periodic coefficients. The methods of solution are illustrated with various examples which indicate the straight-forward procedure for applying the z-transform and the modified z-transform to the solution of difference equations.

Institute for Advanced Study, Princeton, N.J.
MATHEMATICAL SINGIFICANCE OF CONSISTENCY PROOFS, by G. Kreisel. Rept. on Contract DA36-034-ORD-1622. Mar 57, 37p. 31 refs. AD-128 969.
Order from LC mi$3.00, ph$6.30 PB 135 960

A discussion is presented of some applications of consistency proofs. The consistency program is replaced by the program of finding constructive or recursive interpretations of nonrecursive formal systems. The kind of applications which can be made from such interpretations are illustrated, and the applications that have actually been made are explained by comparison with applications of the completeness theorem for the first-order logic. These include the predicate calculus, real-closed and algebraically closed fields, Hilbert's 17th problem, Hilbert's nullstellensatz, arithmetic, and logic. Explanation is given of the procedure by which a characterization of the functions and functional needs for the noncounterexample-interpretation of a system of arithmetic leads to independence proofs for certain formulas. The models needed for these independence proofs are shown to be highly nonconstructive. This does not exclude the possible use of nonstandard models for proving independence results in arithmetic. Interpretations of pure and applied predicate calculi are discussed.

Institute of Statistics, North Carolina U., Chapel Hill.
ASYMPTOTIC POWER AND INDEPENDENCE OF CERTAIN CLASSES OF TESTS ON CATEGORICAL DATA, by Earl Louis Diamond. Rept. on Contract AF 18(600)83. Apr 58, 86p. 20 refs. Mimeograph series no. 196; AFOSR TN-58-549; AD-158 366.
Order from LC mi$4.80, ph$13.80 PB 136 044

Contents:
Basic problems, principles, and definitions
Contingency-like tests for single-multinomial samples
Contingency-like test for product-multinomial samples
Analogues to normal univariate and multivariate analysis of variance tests for single-multinomial samples
Analogues to normal univariate and multivariate analysis of variance tests for product-multinomial samples

Institute of Statistics, North Carolina U., Chapel Hill.
A CLASS OF TWO REPLICATE INCOMPLETE BLOCK DESIGNS, by J. Roy. Rept. on Contract AF 18(600)83. June 58, 21p. 13 refs. Mimeograph series no. 201; AFOSR TN-58-554; AD-158 372.
Order from LC mi$2.70, ph$4.80 PB 135 997

A new class of two replicate designs called Simple Partially Linked Block designs is introduced. It is shown that with any of these designs, the variance of the estimate of the difference in effects of two treatments can be at most of seven different types. The general procedure of intra and inter-block analysis is developed and illustrated with a numerical example. A list of these designs involving ten or fewer plots per block is given together with the values of parameters required in the analysis and the values of the efficiency-factor. It turns out that most of these designs are highly efficient with an efficiency-factor of the order of 75%.

Institute of Statistics, North Carolina U., Chapel Hill.
PERCENTAGE POINTS OF WILKS' L_{mvc} AND L_{vc} CRITERIA, by J. Roy and V. K. Murthy. Rept. on Contracts AF 18(600)83 and Nonr-855(06). June 58, 13p. Mimeograph series no. 200; AFOSR TN-58-553; AD-158 371.
Order from LC mi$2.40, ph$3.30 PB 136 071

An asymptotic series expansion is used to evaluate 5 and 1% points of the distribution of L_{mvc} and L_{vc} criteria for p = 4, 5, 6, 7 and n = 25(5)60(10)100. For higher values of n a correction factor a is provided such that to a high degree of accuracy $-(n-a)\log_e L_{mvc}$ or $-(N-a)\log_e L_{vc}$ is distributed as chi-square. The use of the tables is illustrated with 2 numerical examples. A simple nonparametric alternative procedure is suggested for testing a generalization of the H_{mvc} hypothesis (the means are equal, the variances are equal, and the covariances are equal).

Institute of Statistics, North Carolina U., Chapel Hill.
ROTATABLE DESIGNS OF SECOND AND THIRD ORDER IN THREE OR MORE DIMENSIONS, by R. C. Bose and Norman R. Draper. Rept. on Contract AF 18(600)83. May 58, 137 p. 8 refs. Mimeograph series no. 197; AFOSR TN-58-550; AD-158 367.
Order from LC mi$6.90, ph$21.30 PB 136 074

An attempt is made to meet the need for second and third order designs in 3 or more factors. Several new construction methods for obtaining rotatable designs of second and third order in 3 and higher dimensions are presented. By use of these methods various infinite classes of designs are obtained, and all of the rotatable designs previously known are derivable as special cases of these classes. A general theorem providing the exact conditions under which a third order arrangement is nonsingular is presented.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
SYMMETRICAL BACK-CLAMPED TRANSISTOR SWITCHING CIRCUITS, by R. H. Baker, R. E. McMahon and others. Rept. on Contract AF 19-(122)458. 5 May 56, 22p. Technical rept. no. 120.
Order from LC mi$2.70, ph$4.80 PB 130 883

Described herein is a group of circuits developed for use in digital data-processing equipment. The circuit configurations are symmetrical and employ back-clamping where high rapid circuit response is important. The use of these techniques yields circuits that are very stable, with high efficiency, fast, and require minimum specification of transistor and circuit parameters. The circuits yield maximum utility from the standpoint of building digital systems.

Maryland U., College Park.
DISPERSION RELATIONS AND SCHWARTZ'S DISTRIBUTIONS, by John G. Taylor. Technical rept. no. 109 on Contract AF 49(638)24. [1958] 13p. 10 refs. AFOSR TN-58-630; AD-162 160.
Order from LC mi$2.40, ph$3.30 PB 136 156

This paper is a contribution to the mathematical foundation of the dispersion relations in physics, especially in quantum field theory, from the viewpoint of the distribution theory of L. Schwartz.

Massachusetts Inst. of Tech., Cambridge.
ON SOME PROBLEMS OF GEL'FAND, by Kenneth Hoffman and I. M. Singer. Technical rept. on Contract AF 49(638)42. 28 July 58, 48p. 7 refs. AFOSR TN-58-595; AD-162 119.
Order from LC mi$3.30, ph$7.80 PB 136 034

Michigan U., Ann Arbor.
ACTIONS OF THE GROUPS S 0(3) AND Sp(1) ON THE SPHER S_4 AND S_5, by R. W. Richardson. Rept. on Contract AF 49(638)104. [1958] 63p.

24 refs. AFOSR TN-58-488; AD-158 296.
Order from LC mi$3.90, ph$10.80 PB 136 266

Minnesota U., Minneapolis.
TENSOR PRODUCTS OF BANACH ALGEBRAS, by Bernard R. Belbaum. Rept. on Contract AF 49(638) 64. Apr 58, 21p. 7 refs. AFOSR TN-58-373; AD-154 279.
Order from LC mi$2.70, ph$4.80 PB 135 361

The following theorem is discussed: Let A_1 and A_2 be Banach algebras and $A_T = A_1 \otimes A_2$ be their tensor product, and assume that A_T has a norm $\| \ldots \|_{A_T}$, this makes A_T a normed algebra and satisfies $\| a_1 \otimes a_2 \|_{A_T} = \| a_1 \|_{A_1} \cdot \| a_2 \|_{A_2}$. Let A be the completion of A_T in the norm $\| \ldots \|_{A_T}$, then $\mathfrak{M}$ and $\mathfrak{M}_1 \times \mathfrak{M}_2$ are homeomorphic where $\mathfrak{M}, \mathfrak{M}_1, \mathfrak{M}_2$ are the spaces of 2-sided regular maximal ideals of A, A_1, A_2, and $\mathfrak{M}, \mathfrak{M}_1, \mathfrak{M}_2$ are endowed with appropriate and nontrivial topologies. If M, M_1, M_2 are members of $\mathfrak{M}, \mathfrak{M}_1, \mathfrak{M}_2$, respectively, and if $\varphi, \varphi_1, \varphi_2$ are the epimorphisms ($\varphi: A \to A/M = K$, $\varphi_1: A_1 \to A_1/M_1 = K_1$, and $\varphi_2: A_2 \to A_2/M_2 = K_2$, respectively), then the knowledge of φ yields the knowledge of φ_1 and φ_2, and conversely. The theorem is proved for the case of A_1, A_2 commutative and the topolo-ties of $\mathfrak{M}, \mathfrak{M}_1, \mathfrak{M}_2$, the weak topologies. A 1-to-1 correspondence between $\mathfrak{M}$ and $\mathfrak{M}_1 \times \mathfrak{M}_2$ is set up and shown to be a homeomorphism. The proof is based on the studies of A. Hausner (Abstract 463, 1956; PAMS, April 1957) and G. P. Johnson (Abstract 458, 1956), where a key result of their investigations was the fact that the spaces of the algebras are homeomorphic.

Naval Ordnance Test Station, China Lake, Calif.
TABLES OF RANDOM PERMUTATIONS, by Robert S. Gardner. 31 Jan 57, 32p. 1 ref. NOTS-1531; NAVORD rept. 5301.
Order from LC mi$3.00, ph$6.30 PB 136 412

Tables providing random permutations of the numbers from 1 to N for all N not exceeding 10,000 are presented, together with discussions of their uses, especially in drawing random samples.

Purdue Research Foundation, Lafayette, Ind.
IRREDUCIBLE GENERALIZED SURFACES, by Wendell H. Fleming. Technical note no. 2 on Two Dimensional Problems of the Calculus of Variations, Contract AF49(638)18. Nov 57, 42p. AFOSR TN-57-767; AD-136 757.
Order from LC mi$3.30, ph$7.80 PB 133 322

Two main innovations are applied to the problem of irreducible generalized surfaces. First, conformal mapping for polyhedra of higher topological types was applied in a way similar to the author's recent extension of Morrey's theorem to 2-manifolds. Second, the set of generalized surfaces of given topological type which admit a given set Γ of curves in space as boundary is enlarged to include those which admit Γ as boundary in a certain limiting sense. General conditions (irredeucibility) are given under which the element of the larger set necessarily belongs to the smaller set and possesses a microrepresentation.

Purdue U. Div. of Engineering Sciences, Lafayette, Ind.
ON STOCHASTIC LINEAR SYSTEMS, by J. Clifton Samuels and A. Cemal Eringen. Technical rept. no. 11 on Contract Nonr-1100 (02). Aug 57, 100p. 76 refs.
Order from LC mi$5.40, ph$15.30 PB 135 929

Exact and approximate mathematical methods are developed for determining various moments and probability distribution functions of stochastic linear systems. Experiments are carried out on a combined tuned-plate oscillator and reactance-tube modulator simulating an RLC circuit with random capacity variations. This study appears to confirm the prediction of the theory in that there exist noise levels for which the circuit is unstable in quadratic mean.

South Carolina U., Columbia.
A LINEAR DIFFERENTIAL EQUATION WHOSE COEFFICIENTS INVOLVE q-PERIODIC FUNCTIONS, by Tomlinson Fort. Rept. on Contract AF 18(603)23. May 58, 3p. AFOSR TN-58-364; AD-154 269.
Order from LC mi$1.80, ph$1.80 PB 135 978

South Carolina U., Columbia.
PROBLEM IN LINEAR DIFFERENTIAL EQUATIONS, by Tomlinson Fort. Technical rept. on Contract AF 18(603)23. July 58, 6p. AFOSR TN-58-619; AD-162 148.
Order from LC mi$1.80, ph$1.80 PB 136 157

The problem is based on a suggestion by R. E. Bellman in the Bulletin of the American Mathematical Society Mar 1958, p. 81.

Stanford U., Calif.
RANDOM WALKS, by Samuel Karlin and James McGregor. Technical rept. no. 2 on Contract Nonr-225(28). 15 Oct 57, 29p. 10 refs.
Order from LC mi$2.70, ph$4.80 PB 136 283

Trinity Coll., Hartford, Conn.
CONVERGENCE OF SERIES OF CHARACTERISTIC FUNCTIONS OF THE DIFFERENTIAL OPERATOR-$d^2/dz^2 + z^N$, by W. J. Klimczak. Rept. on Contract AF 18(600)1397. 30 Sep 57, 13p. 6 refs. AFOSR TN-57-605; AD-136 595.
Order from LC mi$2.40, ph$3.30 PB 136 073

[University Coll., Cork (Eire)]
THE HYPERCIRCLE METHOD APPLIED TO THE SOLUTION OF THE BIHARMONIC EQUATION. 1, by V. G. Hart. Rept. on Contract AF 61(514)1163. Dec 57, 82p. AFOSR TN-58-172; AD-152 203.
Order from LC mi$4.80, ph$13.80 PB 135 995

The hypercircle technique utilises a function-space representation in which the point of intersection of two orthogonal linear subspaces corresponds to the solution (which we suppose unique) of a boundary-value problem. General points on the two subspaces correspond to solutions of the original problem with some conditions relaxed and may be easily found. We select a point on each subspace and seek to draw each point close to the point of intersection by means of a least square procedure. Then provided that the metric of function-space is positive-definite (which will always be the case in the subsequent work), the point of intersection of the subspaces is located on a geometrical figure called a hypercircle. When the hypercircle has been found the method provides upper and lower bounds on a certain functional involving the solution of the problem under consideration. Also it is possible to estimate the mean-square error involved at all stages of the process, this quantity being represented by the square of the radius of the hypercircle. In this work we do not obtain pointwise bounds on the solution of a boundary-value problem but methods are available for such a process if desired.

Computing Devices

Battelle Memorial Inst., Columbus, Ohio.
PRELIMINARY SYSTEMS DESIGN AND OPERATIONAL ANALYSIS FOR THE MIFD, by D. B. J. Bridges, J. E. Davis and others. Final technical rept. 28 June-31 Dec 53 on Application of Digital Data-Handling Equipment (MIFD) to the Air Force Inventory-Control Problem, Contract AF 33(616) 2183. 27 Jan 54, 92p. WADC TR-53-505; AD-25 312.
Order from LC mi$5.40, ph$15.30 PB 136 234

This report contains a record of the first constructive work done in developing an MIFS for use with the MIFD in an experimental installation. It is proposed that the computer be programmed to scan the remotely connected input devices, to process the requests for materiel, after checking against stock records held in the computer memory, and to print the proper issue orders on output units located in the warehouse. The initial programming for this system, MIFS-1, is included in this report.

Farrand Optical Co., Inc., New York.
RESEARCH ON ANALOGUE-DIGITAL CONVERTER, PHASE I, by James L. Winget. Rept. on Systems Dynamics Research and Analysis, Contract AF 33(616)380. Mar 56, declassified 13 July 55, 53p. WADC Technical rept. 55-279; AD-93 059.
Order from LC mi$3.60, ph$9.30 PB 136 693

Utilizing a 128-pole Inductosyn unit as a data-measuring element, an analogdigital converter, having an accuracy of + 25 seconds, has been developed by Farrand Optical Co., Inc., New York, N.Y., under sponsorship and direction of the Physics Research Branch, Flight Research Laboratory, Wright Air Development Center. The Inductosyn is a previous development by the same company under Contract AF 33(038)-5135. Basic design principles of the converter are presented together with a simplified explanation of operational theory. Test results, comparing accuracy of the experimental model with a highly accurate (better than five seconds) 108-pole Inductosyn System, are included. With slight modification the instrument can be converted for use as a digital-analog computer.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
CHARACTERISITCS OF SIMPLE MANUAL CONTROL SYSTEMS, by Jerome I. Elkind. Rept. on Contract AF 19(122)458. 6 Apr 56, 147p. 37 refs. Technical rept. no. 111.
Order from LC mi$7.20, ph$22.80 PB 130 844

A method for measuring and describing the characteristics of manual control systems is presented. The method is applied in an experimental study of the characteristics of simple manual systems. The experimental results are discussed and analytic models are derived that approximate the measured characterisitics. An analog computer developed to implement the measurement of the system characteristics is described.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
SYMBOLIC DESIGN TECHNIQUES APPLIED TO A GENERALIZED COMPUTER, by I. S. Reed. Rept. on Contract AF 19(122)458. 3 Jan 57, 9p. Technical rept. no. 141.
Order from LC mi$1.80, ph$1.80 PB 130 877

Techniques for the symbolic design of digital computers are developed and discussed. These techniques are then applied to the development of a generalized computer, having an internal nature that can be programmed with a sequence of micro-instructions. This machine has the capability of simulating the internal nature of any other computer that utilizes the same type of main memory.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
TRANSISTOR CORE MEMORY, by R. E. McMahon and F. L. McNamara. Rept. on Contract AF 19(122)458. 13 Nov 56, 40p. 5 refs. Technical rept. no. 133.
Order from LC mi$3.00, ph$6.30 PB 130 881

A tansistor core memory has been constructed with an appreciable reduction in space and power over tube-driven memories. This memory, with a storage capacity of 4096 32-bit words, occupies 11 cubic feet, and requires 550 watts of power. Circuit details and the "delta noise" problem are discussed. A complete evaluation of the memory relative to transistor failures and operating errors is included.

MECHANICS

Polytechnic Inst. of Brooklyn, N.Y.
INVESTIGATION INTO THE PLASTIC RESPONSE OF STRUCTURES, by P. G. Hodge, Jr. Final rept. for 1 Feb 55-31 Aug 57 on Proj. Planet, Contract Nonr-839(11). 21p. 45 refs. PIBAL rept. no. 404; AD-142 677.
Order from LC mi$2.70, ph$4.80 PB 135 116

These investigations have been pursued in three general directions: basic theory, applications to strain hardening materials, and applications to perfectly plastic materials. Results obtained have been fully presented in the reports listed in Part I of the bibliography; the remainder of the present report will be devoted to a brief review of the results obtained in these three categories.

Aerodynamics and Pneumatics

Advisory Group for Aeronautical Research and Development, Paris (France).
EFFECT OF BOUNDARY LAYER THICKNESS ON FLUTTER OF CONTROL SURFACES: A BRIEF SURVEY OF RELEVANT REPORTS, by N. C. Lambourne. 1958, 5p. 11 refs.
Order from NASA* AGARD-183

Presented at the Seventh Meeting of the Structures and Materials Panel, held from 24th March to 3rd April, 1958, in Rome, Italy

Reports which contain information relevant to an assessment of the influence of the boundary layer on the flutter of control surfaces are listed. All the reports except one are concerned with the aerodyanmic hinge-moments or pressure distributions for oscillating control surfaces and do not deal with flutter directly. The exception contains measurements of flutter characteristics in addition to hinge-moments. For all the measurements it would appear likely that the boundary layer remained attached to the surface of the aerofoil up to the trailing-edge; thus no separation effects are included. Except for one report, conditions are restricted to incompressible flow.

Advisory Group For Aeronautical Research and Development, Paris (France).
A SEARCH FOR DEFINITIONS AND CRITERIA RELATING TO NON-OSCILLATORY DIVERGENCE IN NEAR STEADY FLIGHT CONDITIONS, by E. Billion. Aug 56, 18p. 2 refs.
Order from NASA* AGARD-72T

Presented at the Joint Session of AGARD Flight Test Techniques and Wind Tunnel Panels held from August 27th to 31st, 1956, in Brussels, Belgium

*National Aeronautics and Space Administration, 1520 H Street, N.W., Washington 25, D.C.

The usual expression 'static stability' raises certain difficulties of interpretation in the case of a system with several degrees of freedom. The point of view held by the author consists in isolating from the phenomena following a disturbance those which have a non-oscillatory character. Within the scope of linear approximation, only the real roots of the characteristic equation governing the system are thus taken into consideration. Without having to calculate each of these roots, certain comprehensive facts are given by the constant term of the characteristic equation, which can then serve, with certain precautions, as a criterion of non-oscillatory divergence.

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
PARAMETRIC INVESTIGATION OF GUST LOADS ON RIGID AIRPLANES IN TWO DEGREES OF FREEDOM, by Claude W. Brenner and Gabriel Isakson. Rept. on Contract NOa(s) 51-183-C. 6 Oct 52, 120p. 12 refs.
Order from LC mi$6.00, enl pr$18.30 PB 136 789

Aircraft Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
PERFORMANCE OF FLARED EXHAUST DUCTS SUITABLE FOR JET FLAP APPLICATIONS, by Robert C. Lopiccolo, Raymond Z. Nelsen, Jr., and Ahto Palm-Leis. Rept. on External and Internal Aerodynamics. Apr 58, 48p. 6 refs. WADC Technical rept. 57-592; AD-151 186.
Order from OTS $1.25 PB 151 466

The thrust loss and flow characteristics of flared ducts suitable for application in a jet flap or jet wing system were obtained experimentally. Three flared duct models were tested and results compared with the performance of a cylindrical duct configuration at given values of weight flow and pressure ratio. The results are presented in the form of velocity coefficient and flow coefficient versus pressure ratio for the various configurations. Also presented is the percent thrust loss relative to the cylindrical duct. Thrust losses as low as two percent were obtained for the best configuration tested and less than ten percent for the worst, a simple tinsmith's transition duct. Flow distribution at the exit of the flared ducts was measured. This showed that maintaining uniform flow at the blowing slot for the two better ducts is not a problem, especially at the lower exit to inlet area ratios.

Armour Research Foundation, Chicago, Ill.
THEORETICAL INVESTIGATIONS OF SONIC BOOM PHENOMENA, by R. A. Struble, C. E. Stewart and others. Rept. for 1 Jan 56-31 July 57, Contract AF 33(616)3371. Aug 57, 245 p. 36 refs. WADC Technical rept. 57-412; AD-130 883.
Order from OTS $3.50 PB 151 354

An investigation has been made to determine the pressure and shock wave characteristics due to a body (i. e., aircraft) in arbitrary motion. In

addition, the propagation of these shocks through the atmosphere has been studied, and the effects of many parameters such as Mach number, acceleration, altitude, and slenderness ratio have been determined. This program was completely theoretical in nature. The final report has been prepared in two parts as follows: Part I, "Linear Theory", which presents the general theory applicable to sonic boom. Part II, "Quantitative Studies of Sonic Boom Variables", which contains an explicit and detailed evaluation. In the first analysis this entails the application of the theory presented in Part I to specific cases by extensive computations covering all pertinent ranges of the variables concerned. Chapters I, II, III, and Appendices A and B of Part II present the detailed results of the sonic boom study. In the main, the results are quantitative and were obtained from computations performed on the ARF digital computer. Numerous curves are presented depicting the effects of the significant physical variables and parameters. In Chapters IV through VII related topics are discussed with regard to their qualitative effects on sonic boom phenomena.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
CYLINDRICAL SHOCK WAVES FROM EXPLODING WIRES, by Frederick D. Bennett. Apr 58, 17p. 13 refs. Rept. no. 1035.
Order from LC mi$2.40, ph$3.30 PB 135 346

A simple technique has been found for rendering visible the shock wave formed by an exploding wire after the shock has separated from the luminous contact surface. A small, plane mirror is placed just behind the wire so as to be perpendicular to the axis of the optical system. Thus the reflected image of the wire explosion coincides with the disturbance itself when seen through the slit by the camera lens. Rotating mirror pictures taken under these conditions show very clear outlines of the parabolic shock wave as it propagates ahead of the luminous contact surface.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
TRANSONIC FREE FLIGHT RANGE, by Walter K. Rogers, Jr. June 58, 57p. 24 refs. Rept. no. 1044; rev. of Rept. no. 849.
Order from LC mi$3.60, ph$9.30 PB 135 347

The Transonic Free Flight Range, developed for ballistic and aerodynamic research, has been in operation for approximately eight years. The accuracy and reliability of the results obtained from this range make it a valuable tool for the free flight testing of missiles and for research in compressible flow phenomena.
The range, its instrumentation, and the experimental procedures associated with their use are described. The various records obtained in the range and an indication of the method employed in the reduction of the raw data into final aerodynamic coefficients are also described. An appendix outlines the steps and reasoning behind the design of the Transonic Range.

Brown U., Providence, R.I.
THEORETICAL RESEARCH ON HYPERSONIC FLOWS, by Ronald F. Probstein. Preliminary rept. 13 Dec 54-12 Dec 55, on Contract AF 33(616)2798. Jan 56, 21p. 15 refs. WADC Technical note 56-16; AD-83 806.
Order from LC mi$2.70, ph$4.80 PB 136 079

Results are summarized on the following studies: high-temperature gas phenomena; inviscid flow over sharp-nosed bodies; interacting laminar boundary-layer flow; inviscid blunt-body flow; laminar boundary-layer flow over blunt bodies; and combined effects - viscous flow over a flat plate with finite leading-edge thickness.

Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
SUMMARY OF INSTRUMENTATION DEVELOPMENT AND AERODYNAMIC RESEARCH IN A HYPERSONIC SHOCK TUNNEL, by Charles E. Wittliff and George Rudinger. Final summary rept. for Mar 54-July 58 on Contract AF 33(616)2387. Aug 58, 73p. 32 refs. WADC Technical rept. 58-401, pt. 1; AD-155 758.
Order from OTS $2.00 PB 151 488

Analytical and experimental research devoted to devising, developing, and applying instrumentation and techniques to measuring aerodynamic forces and heat transfer rates on a cone at an angle of attack are reported. The development of a thin metal resistance thermometer mounted on an insulating body is summarized, and experimental heat transfer rates measured on a cone in the C.A.L. hypersonic shock tunnel are presented. An accelerometer balance system is described and experimental force measurements on a cone are also reported. A preliminary theoretical analysis of the flow about yawed cones at hypersonic speeds is reported. The flow uniformity in the test section and the time required for the flow about a model to become completely established have also been studied.

Directorate of Flight and All-Weather Testing, Wright-Patterson AFB, Ohio.
ANALYTICAL METHOD FOR OBTAINING THE TRANSIENT RESPONSE OF LINEAR THIRD ORDER SERVO SYSTEMS WITH CONSTANT PARAMETERS, by Raymond B. Block. May 56, 29p. WADC Technical rept. 56-246; AD-108 043.
Order from LC mi$2.70, ph$4.80 PB 137 157

The central problem in calculating the transient response of any linear servo system with constant parameters is that of finding the roots of an algebraic equation, called the characteristic equation of the system. In this report a method is presented for calculating the transient response of a third-order system of this type that does not require the direct solution of the characteristic equation.

The method is published because of its simplicity and because of the possibility of its extension to systems of higher order than the third, for which algebraic formulas that express the roots of the characteristic equation in terms of the coefficients are either complicated or non-existent.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
THEORETICAL AND EXPERIMENTAL EFFECT OF SWEEP UPON THE STRESS AND DEFLECTION DISTRIBUTION IN AIRCRAFT WINGS OF HIGH SOLIDITY. PART 9. ON THE STRESSES IN CANTILEVER PLATES OF ARBITRARY PLANFORM AND VARIABLE THICKNESS (A RELAXATION PROCEDURE WITH APPLICATIONS TO THE SWEPT WING PROBLEM), by Y. C. Fung. Rept. for July 49-Oct 50 on Contract W33-038-ac-16961. 136p. 9 refs. AF Technical rept. 5761, pt. 9; ATI-108 567.
Order from LC mi$6.90, ph$21.30 PB 136 199

With the advent of tapered, swept thin wings of high solidity, existing methods of stress and load analysis have become inadequate. Research was carried out at the Guggenheim Aeronautical Laboratory of the California Institute of Technology to investigate the effect of sweep upon the deflection and stress patterns of wings of high solidity. This report presents a relaxation method for determining the stress and deflection patterns for cantilever plates with sweep. Problems of variable thickness and mixed boundary conditions are solved using this method.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
THEORETICAL AND EXPERIMENTAL EFFECT OF SWEEP UPON THE STRESS AND DEFLECTION DISTRIBUTION IN AIRCRAFT WINGS OF HIGH SOLIDITY. PART XI. AN EXPERIMENTAL INVESTIGATION OF THE STRESSES AND DEFLECTIONS IN A SWEPT THICK-WALLED BOX BEAM, by M. L. Williams and G. M. Hrebec. Final rept. on Contract W33-038-ac-16961. 30 Sep 50, 75p. 6 refs. [AF Technical rept. 5761, pt. 11] ATI-91384.
Order from LC mi$4.50, ph$12.30 PB 136 200

The contents of this report present experimental deflection and stress data for a swept thick-walled aluminum box beam of the same general size as the companion plate specimen of uniform thickness experimentally investigated and reported in Air Force Technical Report 5761-3. The present cantilever specimen of approximately 40 inch span and 10 inch chord was tested at a 60 degree sweep angle, for two structural thickness ratios of 15 and 25 per cent, and at a 40 degree sweep for the 15 per cent thickness ratio.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
THEORETICAL AND EXPERIMENTAL EFFECT OF SWEEP UPON STRESS AND DEFLECTION DISTRIBUTION IN AIRCRAFT WINGS OF HIGH SOLIDITY PART 12. ON THE STRESSES AND DEFLECTIONS OF SWEPT THICK-WALLED BOX BEAMS, by Y. C. Fung. Final rept. Feb-Sep 50 on Contract W33-038-ac-16961. 127p. 11 refs. AF Technical rept. 5761, pt. 12; ATI-90 111.
Order from LC mi$6.30, ph$19.80 PB 136 201

The theory is developed in detail for a box beam of relatively small thickness ratio which has uniform symetrical cross sections. Methods for extensions to other more general cases are indicated. In particular, it can be extended to non-symmetrical sections. Thus the problems of avoiding the stress concentrations at the rear spar by reducing its height, (i.e., the wing thickness at the scope of this simple theory.

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
ANALYSIS OF SECONDARY FLOW IN THE STATOR OF AN AXIAL TURBOMACHINE, by Henk G. Loos. Technical rept. no. 3 on Analytical Investigation of Secondary Flow in Wind Tunnel Axial Compressor Stages, Contract AF 18(600)178. Sep 53, 73p. 14 refs. AD-20 614.
Order from LC mi$4.50, ph$12.30 PB 137 394

The strickly linearized theory of secondary flow in turbomachine cascades breaks down when the turning angle through the cascade is of the magnitude usually employed in practice. Using the experimental fact that the secondary vorticity has been transported to the blade row, a model is developed which allows extension of the analysis to realistic situations. The method is employed to calculate the circulation distribution and the gap-wise average of downwash velocity for a plane cascade situated between two walls having thick boundary layers. The losses which may directly or indirectly be attributed to the secondary flow are calculated and found to constitute an appreciable fraction of the loss observed experimentally.

Institute for System Research, U. of Chicago, Ill.
DETERMINING AIR REACTIONS ON MOVING VEHICLES. PART II. METHODS OF ROCKETRY, by M. Z. Krzywoblocki. Rept. on Contract AF 33(616)5689. July 58, 99p. 474 refs. WADC Technical rept. 56-51, pt. 2; AD-161 004.
Order from OTS $2.25 PB 151 478

This second volume in a series of five surveys the contributions to knowledge of air reactions on moving vehicles that have been made by people who were primarily concerned with trajectories of unguided rockets. The first section of this volume contains fairly explicit reviews of important books that have been published in this field. Basic principles are outlined and numerous quantitative relationships are shown. Particular attention is given to Poisson, Magnus, and gyroscopic effects and to other phenomena that become more prominent as flight speeds, altitudes, and times increase. The

second section presents listings, with brief descriptive notations, of significant technical papers. An appended bibliography contains 474 references to the domestic and foreign literature on this subject.

Institute of Engineering Research, U. of California, Berkeley.
AFTERGLOW INVESTIGATIONS OF SHOCK DETACHMENT DISTANCES AT LOW REYNOLDS NUMBERS, by E. S. Moulic. Rept. on Wind Tunnel Studies, Glow and Absorption Methods of Flow Visualization for Use in a Large Hypersonic Wind Tunnel, Contract AF 33(616)2852. 15 July 58, 61p. 11 refs. WADC Technical rept. 57-643; AD-155 795.
Order from OTS $1.75 PB 151 449

An air afterflow flow visualization apparatus and free molecule probe were used to determine shock detachment distances for blunt bodies in the range $1.8 < M < 2.8$ and $100 < Re/inch \quad 1200$. Cylindrical models were used to develop the experimental techniques and reasonable agreement was shown between detachment distances measured by afterglow and free molecule probe techniques. Spherical model detachment distances were obtained by the afterglow technique and when corrected for boundary layer effects showed satisfactory agreement with the predictions of Heybey, provided isentropic flow existed between the shock wave and the boundary layer. It was concluded that shock detachment distances in rarefied gas flows depend on Reynolds as well as Mach number.

Institute of Engineering Research, U. of California, Berkeley.
THE EFFECT OF FREE STREAM TURBULENCE ON THE HEAT TRANSFER FROM CYLINDERS, by R. A. Seban. Rept. on Contract AF 33(616)348. Sep 57, 41p. 13 refs. Series 41, Issue 18; WADC Technical rept. 57-480; AD-155 766.
Order from OTS $1.25 PB 151 417

Results are presented for local heat transfer coefficients and recovery factors for two dimensional air flow over an elliptic and a circular cylinder to demonstrate the effect of screen produced turbulence in the incident air stream, the velocity of which was varied from 140 50 380 ft/sec. In addition to the expected alteration of transition to turbulence, the salient effects were a substantial increase in the heat transfer to the laminar boundary layer in the vicinity of the stagnation point, and no effect whatsoever on the recovery factor in the laminar flow region. Turbulence levels and power spectra for the turbulence are presented, and these are to some extent anomalous because of the relatively high turbulence level of the clear tunnel and the difficulty of comparison to existing screen results that have been obtained with velocities an order of magnitude lower. Comparison of the increased heat transfer and the turbulence levels yields not even an empirical relation, and this report shows that existing theories are inadequate to support explanations of the observed effects.

Institute of Engineering Research, U. of California, Berkeley.
HEAT TRANSFER TO BOUNDARY LAYERS WITH PRESSURE GRADIENTS, by R. A. Seban and H. W. Chan. Rept. on Contract AF 33(616)348. May 58, 97p. 39 refs. Series 41, Issue 16; WADC Technical rept. 57-111; AD-118 075.
Order from OTS $2.25 PB 151 414

Methods of prediction of the heat transfer to laminar and turbulent boundary layers are presented. Variable free stream velocity and variable wall temperature are considered with a view toward the specification of optimum calculation methods. For laminar boundary layers with almost constant properties a few methods showing typical methods of attack are reviewed and compared to experiment. It appears that Lighthill's method, properly modified, can be recommended for general application, although in certain instances, the error in the predicted heat transfer may attain 20%. When the flow is laminar and the properties are variable, the prediction methods become complicated and a specific comparison with experiment is not possible. If, however, the problem is simplified, as for instance by almost constant temperature at the wall and a continuously accelerated flow, then it is shown that even the simple methods intended for constant property flows are adequate for high Mach numbers. With turbulent flows, the absence of exact solutions for a given kind of variation of free stream velocity and of wall temperature, as do exist for laminar flow, makes even more tenuous the arbitrary assumptions necessary to the development of approximate calculation methods of the required generality. The conventional approximations made concerning the integration of the energy equation are examined in some detail, and a comparison of results to experiment fails to indicate decisively a preferred calculation method. Certainly the dependence of the thermal on the hydrodynamic behavior is much less than in laminar flow, and it appears that a complete neglect of the hydrodynamic behavior provides heat transfer predictions in which the error may not exceed 30%.

National Advisory Committe for Aeronautics, Washington, D.C.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF AERODYNAMIC FORCES AND MOMENTS ON LOW-ASPECT-RATIO WINGS UNDERGOING FLAPPING OSCILLATIONS, by Donald S. Woolston, Sherman A. Clevenson, and Sumner A. Leadbetter. Aug 58, 25p. 5 refs.
Order from NASA* NACA TN-4302

Forces and moments associated with flapping oscillations of finite wings at low speeds are considered. A comparison of theoretical results, based on lifting-surface theory, and experimental results is made for a rectangular wing of aspect ratio 2. Calculated results are also given for three tapered wings of aspect ratio 3 with varying amounts of sweepback.

*National Aeronautics and Space Adminstration, 1520 H Street, N.W., Washington 25, D.C.

National Advisory Committee for Aeronautics, Washington, D.C.
COMPRESSIBLE LAMINAR FLOW AND HEAT TRANSFER ABOUT A ROTATING ISOTHERMAL DISK, by Simon Ostrach and Philip R. Thornton. Aug 58, 18p. 9 refs.
Order from NASA* NACA TN-4320

The flow and heat transfer about a rotating isothermal disk are reexamined to include the effects of compressibility and property variations. If viscous dissipation is neglected, the compressible problem is correlated to the incompressible problem by assuming linear variations of viscosity and thermal conductivity with temperature. Certain inaccuracies in several previous incompressible solutions are noted and corrected. The effect of compressibility appears as a distortion of the normal coordinate and normal velocity component and as a multiplicative factor in the heat-transfer coefficient, the Nusselt number, and in the expressions for the skin-friction components and torque required to rotate the disk.

National Advisory Committee for Aeronautics, Washington, D.C.
EFFECTS OF COMPRESSIBILITY ON ROTOR HOVERING PERFORMANCE AND SYNTHESIZED BLADE-SECTION CHARACTERISTICS DERIVED FROM MEASURED ROTOR PERFORMANCE OF BLADES HAVING NACA 0015 AIRFOIL TIP SECTIONS, by James P. Shivers and Paul J. Carpenter. Sep 58, 28p. 9 refs.
Order from NASA* NACA TN-4356

An investigation has been conducted at the Langley helicopter test tower to determine the low tip Mach number blade maximum mean lift coefficient and high tip Mach number compressibility effects. Data are presented for blade tip Mach numbers from 0.27 to 0.81 and corresponding Reynolds numbers from 1.64×10^6 to 4.78×10^6. Synthesized rotor-blade section-lift and profile-drag-coefficient data derived from experimental data are presented and compared with previously obtained two-dimensional data.

National Advisory Committee for Aeronautics, Washington, D.C.
MASS TRANSFER COOLING NEAR THE STAGNATION POINT, by Leonard Roberts. Sep 58, 42p. 9 refs.
Order from NASA* NACA TN-4391

A simplified analysis is made of mass transfer cooling - that is, injection of a foreign gas - near the stagnation point for two-dimensional and axisymmetric bodies. The reduction in heat transfer is given in terms of the properties of the coolant gas and it is shown that the heat transfer may be reduced considerably by the introduction of a gas having appropriate thermal and diffusive properties. The mechanism by which heat transfer is reduced is discussed.

National Adivsory Committee for Aeronautics, Washington, D.C.
MATRIX METHOD FOR OBTAINING SPANWISE MOMENTS AND DEFLECTIONS OF TORSIONALLY RIGID ROTOR BLADES WITH ARBITRARY LOADINGS, by Alton P. Mayo. Aug 58, 51p. 7 refs.
Order from NASA* NACA TN-4304

The method includes the cantilever, teetering, and hinged blades in hovering and in steady forward flight. The method is comparatively short, involves only standard matrix procedures, and does not require that the mode shapes or natural frequencies be known.

National Advisory Committee for Aeronautics, Washington, D.C.
METHOD FOR CALCULATING THE AERODYNAMIC LOADING ON AN OSCILLATING FINITE WING IN SUBSONIC AND SONIC FLOW, by Harry L. Runyan and Donald S. Woolston. 1957, 32p. 37 refs. Supersedes TN 3694; AD-104 688.
Order from GPO $0.30 NACA rept. 1322

A method is presented for calculating the loading on a finite wing oscillating in subsonic or sonic flow. The method is applicable to any plan form and may be used for determining the loading on deformed wings. The procedure is approximate and requires a numerical integration over the wing surface.

National Advisory Committee for aeronautics, Washington, D.C.
SOME FACTORS AFFECTING THE VARIATION OF PITCHING MOMENT WITH SIDESLIP OF AIRCRAFT CONFIGURATIONS, by Edward C. Polhamus. Aug 58, 35p. 22 refs. Supersedes Research memo. RM L55E20b, AD-64 306.
Order from NASA* NACA TN-4016

A brief study of available wind-tunnel data with regard to the variation of pitching-moment coefficient with sideslip angle is presented. The effects of such factors as wing plan form, wing-body interference, and tail location are illustrated and discussed, and regions where additional data are needed are indicated.

National Advisory Committee for Aeronautics, Washington, D.C.
STATIC LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS AT LOW SPEED OF 60° SWEPTBACK-MIDWING MODELS HAVING WINGS WITH AN ASPECT RATIO OF 2, 4, OR 6, by Walter D. Wolhart and David F. Thomas, Jr. Sep 58, 41p. 8 refs.
Order from NASA* NACA TN-4397

*National Aeronautics and Space Administration, 1520 H Street, N.W., Washington 25, D.C.

An experimental investigation was performed to determine the contribution of the various components and combinations of components to the static longitudinal and lateral stability characteristics. Emphasis has been placed on the directional stability characteristics, and the results show that all complete model configurations became directionally unstable in the moderate to high angle-of-attack range. This loss in directional stability is attributed to the large unstable contribution of the wing-fuselage combination and to the decrease in vertical-tail contribution with increasing angle of attack.

National Advisory Committee for Aeronautics, Washington, D.C.
SUPERSONIC WAVE INTERFERENCE AFFECTING STABILITY, by Eugene S. Love. Sep 58, 19p. Supersedes Research memo. RM L55L14a, AD-95 986; AD-202 030.
Order from NASA* NACA TN-4358

Some of the significant interference fields that may affect stability of aircraft at supersonic speeds are briefly summarized. Illustrations and calculations are presented to indicate the importance of interference fields created by wings, bodies, wing-body combinations, jets, and nacelles.

National Advisory Committee for Aeronautics, Washington, D.C.
TEMPERATURE AND THERMAL-STRESS DISTRIBUTIONS IN SOME STRUCTURAL ELEMENTS HEATED AT A CONSTANT RATE, by William A. Brooks, Jr. Aug 58, 77p. 5 refs.
Order from NASA* NACA TN-4306

Analytical solutions are given for the temperature and thermal-stress distributions in thick skins and structural elements such as angle, channel, T-, and H-sections when heated at a constant rate. Certain of the analytical solutions are evaluated for selected cross-sectional proportions. The results are presented in the form of charts involving dimensionless temperature, stress, and time parameters and therefore are applicable for different materials and heating rates and absolute size of the section. The results have been found useful for analyzing and correlating experimental data.

National Advisory Committee for Aeronautics, Washington, D.C.
THEORETICAL DISTRIBUTION OF LAMINARY-BOUNDARY-LAYER THICKNESS, BOUNDARY-LAYER REYNOLDS NUMBER AND STABILITY LIMIT, AND ROUGHNESS REYNOLDS NUMBER FOR A SPHERE AND DISK IN INCOMPRESSIBLE FLOW, by Neal Tetervin. Sep 58, 36p. 13 refs.
Order from NASA* NACA TN-4350

Calculations have been made by use of an approximate method for a sphere in the supercritical Reynolds number region. The same quantities have also been calculated for the front face of a much blunter body, namely, for a disk. For the disk the unusual result obtained was that the boundary-layer thickness decreased with an increase in distance from the stagnation point. Only at extremely large Reynolds numbers did the laminar boundary layer over a disk or over the forward portion of a sphere become unstable with respect to the Tollmien-Schlichting type of waves.

National Advisory Committee for Aeronautics, Washington, D.C.
TURBULENCE AND TEMPERATURE FLUCTUATIONS BEHIND A HEATED GRID, by R. R. Mills, Jr., A. L. Kistler, V. O'Brien, and S. Corrsin (Johns Hopkins U.). Aug 58, 67p. 17 refs.
Order from NASA* NACA TN-4288

In the approximately isotropic velocity and temperature fluctuation fields behind a hot grid, measurements were made of fluctuation levels and of various double and triple correlation coefficient functions are of roughly the same spatial extent for the vector and scalar fields. As anticipated from theoretical considerations, the temperature fluctuations die out more slowly than does the turbulence.

National Aeronautical Research Inst. (Netherlands).
THE INFLUENCE OF NON-STATIONARY STABILITY DERIVATIVES ON THE SNAKING MOTION AT HIGH SUBSONIC SPEED, by J. Yff. Rept. on Contract AF [61](514)879. 23 Nov 57 [37]p. Rept. no. F-208; AFOSR TR-58-20; AD-152 012.
Order from LC mi$3.00, ph$6.30 PB 133 242

Some lateral stability calculations with two degrees of freedom for flight at high subsonic speed have been performed in order to study the influence of the non-stationary stability derivatives on the damping of the snaking motion. These derivatives can be determined theoretically for the case of small aspect ratios and with compressibility taken into account. It is found that the theoretical non-stationary stability derivatives for vertical tails are practically independent of the reduced frequency.

Naval Ordnance Lab., White Oak, Md.
A METHOD FOR CALCULATING TURBULENT BOUNDARY LAYER DEVELOPMENT IN SUPERSONIC AND HYPERSONIC NOZZLES INCLUDING THE EFFECTS OF HEAT TRANSFER, by J. Persh and R. Lee. June 56, 48p. 7 refs. Aeroballistic Research rept. 320; NAVORD rept. 4200.
Order from LC mi $3.30, ph$7.80 PB 128 385

A method for calculating the development of turbulent boundary layers in supersonic and hypersonic nozzles has been devised. Although the present method is basically the same as that previously used, it contains several improvements and also includes the previously neglected effects of heat trnasfer. A number of examples of the results obtained using the method described herein are presented.

*National Aeronautics and Space Administration, 1520 H Street, N.W., Washington 25, D.C.

Comparisons between experimental boundary-layer parameters measured in the test section of a hypersonic nozzle with those calculated by the present method demonstrate that the method yields results which are in good agreement with experiment.

Polytechnic Inst. of Brooklyn, N.Y.
GENERALIZATION OF INTEGRAL RELATIONSHIPS WITH APPLICATIONS IN WING-BODY INTERFERENCE, WING THEORY, AND DIFFRACTION OF PULSES, by Lu Ting. Rept. on Contract AF 18(600)693. Apr 57, 42p. 15 refs. Rept. no. 379; AFOSR TN-57-159; AD-126 451.
Order from LC mi$3.30, ph$7.80 PB 136 221

A theorem is proved concerning the integrated properties of the linearized pressure distribution on a cylindrical surface in supersonic stream when the normal velocity on the cylindrical surface is prescribed.

Polytechnic Inst. of Brooklyn, N.Y.
TURBULENT MIXING OF TWO NON-REACTING GASES, by Luigi G. Napolitano. Rept. on Contract AF 18(600)603. Jan 57. 29p. PIBAL 323; AFOSR TN-57-41; AD-115 079.
Order from LC mi$3.00, ph$6.30 PB 134 411

A preliminary investigation of two-dimensional free turbulent mixing of two non-reacting gases in the absence of axial pressure gradients is presented. A linear dependence on the velocity ratio of mass concentration and stagnation enthalpy of the mixture is proved to exist when the turbulent Prandtl and Schmidt numbers are both assumed to be one. The possibility of determining the combined effects of velocity, temperature and concentration gradients by means of solutions of a single total differential equation is demonstrated.

Rensselaer Polytechnic Inst., Troy, N.Y.
INVISCID HYPERSONIC FLOW AROUND SPHERES AND CIRCULAR CYLINDERS, by E. Dale Martin. Rept. on Contract AF 18(600)1591. Apr 58, 82p. 19 refs. TR-AE5807; AFOSR TN-58-448; AD-158 254.
Order from LC mi$4.80, ph$13.80 PB 135 614

This paper presents an approximate method for calculating such flows about spheres and circular cylinders in steady hypersonic flow and gives results in terms of simple closed form analytical expressions.

Research, Inc., Hopkins, Minn.
RESEARCH INTO THE APPLICATION OF RADIANT HEATING TO THE STRUCTURAL TESTING OF AIRCRAFT AT ELEVATED TEMPERATURES, by J. S. Berman. Rept. on Contract AF 33(616)2162. 30 June 54, 56p. 32 refs. AD-112 954.
Order from LC mi$3.60, ph$9.30 PB 137 097

Development of a Radiant Heating Test Facility to simulate aerodynamic heating during structural testing of aircraft. The Unit provides the high intensity of heat required and a oven construction to accommodate various sizes and shapes of aircraft surfaces.

Rosemount Aeronautical Labs., U. of Minnesota, Minneapolis.
MASS-TRANSFER COOLING OF A 20° POROUS CONE AT M = 5, by B. M. Leadon, C. J. Scott, and G. E. Anderson. Rept. on Contract AF 18(600)1226. July 57, 48p. 12 refs. Research rept. no. 143; AFOSR TN-57-461; AD-136 452.
Order from LC mi$3.30, ph$7.80 PB 137 094

Laminar recovery factor, local heat transfer, and surface concentration measurements have been conducted on a 20° porous cone at a nominal Mach number of 5 using both air and helium as the transpired gas. Measured heat transfer coefficients correlate well with the theories of Low[1] and Baron[2] when presented vs. two modified blowing parameters chosen to account for the non-ideal permeability distribution. The laminar conical boundary layer was demonstrated to be quite stable at this Mach number both with zero injection and with air and helium injection.

University of Southern California Engineering Center, Los Angeles.
LOW-DRAG SPECIFICATION OF SURFACE IRREGULARITIES, by Jay Wm. Stuart, Jr. Rept. on Contract AF 18(600)1145. 31 Mar 58, 15p. 4 refs. USCEC rept. 40-203; AFOSR TN-58-404; AD-158 207.
Order from LC mi$2.40, ph$3.30 PB 136 072

By a re-interpretation of the experimental results on boundary-layer transition by Tani and Dryden readily useable nomographs are obtained which can be utilized for engineering purposes.

Hydrodynamics, Hydraulics, and Hydrostatics

Acoustics Lab., Columbia U., New York.
STUDY OF THE PHYSICS OF PERTURBATION OF SUBSONIC CIRCULAR JETS, by R. L. Wegel. Technical rept. no. 2 on Contract Nonr-266(23). 29 May 53, 36p. AD-13 229.
Order from LC mi$3.00, ph$6.30 PB 136 409

Small departures from steady flow of a subsonic circular jet in an incompressible inviscid fluid are described in terms of a series of wave mode functions. The potential of a typical component mode (representing the velocity potential in cylindrical coordinates along the jet axis) is expressed in terms of a modified Bessel function and H_s, a unit amplitude periodic function of θ. On the jet surface, H_s represents a (1) series of longitudinal ridges modulated sinusoidally along it and moving downstream and/or (2) spiral ridges. The instability of columnar flow is described by the growth in

amplitude along the jet. The stabilizing influence of viscous forces in real jet results in disintegration terminal turbulence at a much slower rate than that indicated by idealized theory. Experimental data are necessary to obtain a more definitive rationalization of this phenomenon in real jets. Theoretical and experimental wave-transmission techniques are shown to be applicable.

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THE MOLECULAR STRUCTURE OF LIQUIDS, by John S. Dahler. Oct 58, 53p. 31 refs. WADC Technical rept. 58-537; AD-203 386.
Order from OTS $1.50 PB 151 492

A review is presented of the statistical theories for the liquid state with special attention being given to the method of the radical distribution function, the cell theory, and the recent Monte Carlo experiments.

California Inst. of Tech., Pasadena.
INCIPIENT CAVITATION AND WAKE FLOW BEHIND SHARP-EDGED DISKS, by R.W. Kermeen and B.R. Parkin. Rept. on Contract Nonr-220(28) Aug 57, 61p. 15 refs. Engineering Div. rept. no. 85-4.
Order from LC mi $3.90, ph $10.80 PB 135 750

An experimental study in the High Speed Water Tunnel, California Institute of Technology, has been made of cavitation inception in the wake behind a family of harp-edged circular disks. The effects of model size and free stream velocity on incipient cavitation number are discussed. The structure of the turbulent wake has been investigated by high-speed photography of dye injected into the free stream layers which spring from the disks. Static pressure measurements were also made in the flow down stream of two disks. High-speed magnified motion pictures were used to study the growth of cavitation bubbles in the shear layer. These results were used in a semi-empirical analysis of the inception process.

David Taylor Model Basin, Washington, D.C.
ANALYSIS OF STRESSES AT THE REINFORCED INTERSECTION OF CONICAL AND CYLINDRICAL SHELLS, by Edward Wenk, Jr. and C.E. Taylor. Mar 53, 23p. 9 refs. Rept. no. 826.
Order from LC mi$2.70, ph $4.80 PB 136 472

Approximate equations are developed for the equilibrium of complete conical shells, and the results are extended for the practical stress analysis of cone-cylinder intersections reinforced with ring stiffeners. The effects of the approximation are explored to determine geometries for which the analysis is valid. For several examples of cones of certain shapes, the approximate theory gave results in good agreement with the relatively exact solution of Dubois. The derived coefficients of edge displacements and rotations provide a convenient method for analyzing the strength of pressure vessels which incorporate conical components.

Hydrodynamics Lab., Mass. Inst. of Tech., Cambridge.
TURBULENCE MEASUREMENTS IN FREE SURFACE FLOW WITH AN IMPACT TUBE-PRESSURE TRANSDUCER COMBINATION, by A.T. Ippen, R.S. Tankin and F. Raichlen. Technical rept. on Contract N5ori-078(74). July 55, 114p. 51 refs. AD-70 105.
Order from LC mi $6.00, ph $18.30 PB 136 290

This report presents the results of an investigation into the suitability of the use of an impact tube in combination with a capacitance type pressure transducer in measurements of mean turbulence properties. The design features of the instrument which was finally adopted along with a theoretical analysis of its mechanical system are included herein.

Polytechnic Inst. of Brooklyn, N.Y.
PHENOMENOLOGICAL THEORY OF THE FREE TURBULENT FLOW OF A NON-REACTING BINARY GAS MIXTURE, by Luigi G. Napolitano. Rept. on Contract AF 18(600)693. Dec 56, 47p. PIBAL rept. no. 317; AFOSR TN-57-39; AD-115 077.
Order from LC mi $3.30, ph $7.80 PB 136 236

METALLURGY

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
USE OF DIAMOND ABRASIVES IN METALLOGRAPHIC PROBLEMS, by E.C. Older. Mar 58, 19p. 7 refs. Memo. rept. no. MR-669.
Order from OTS $0.50 PB 151 042

A polishing procedure incorporating the use of diamond abrasives was developed for assignments representing the three major problem areas in metallographic preparation of ferrous and nonferrous alloys, namely, loss of nonmetallic inclusions, surface distortion, and insufficient flatness of field. It was found that one basic procedure could be used, avoiding the need of specialized techniques and experience.

Sintercast Corp. of America, Yonkers, N.Y.
RESEARCH ON HEAT RESISTANT ALLOYS STRENGTHENED AT ELEVATED TEMPERATURES BY INCORPORATION OF FINE PARTICULATE SUBSTANCES, by Eric Gregory, Martin Epner, and Claus G. Goetzel. Interim rept. no. 3 on Contract NOas 56-227c. June 56, 13p.
Order from LC mi $2.40, ph $3.30 PB 135 381

Sintercast Corp. of America, Yonkers, N.Y.
RESEARCH ON HEAT RESISTANT ALLOYS STRENGTHENED AT ELEVATED TEMPERATURES BY INCORPORATION OF FINE PARTICULATE SUBSTANCES, by Eric Gregory and Martin Epner. Interim rept. no. 5, 17 July-16 Sep 56, on Contract NOas-56-227c. Oct 56, 21p.
Order from LC mi $2.70, ph $4.80 PB 135 908

Stress-rupture tests at 1500-1800°F of 80:20 nickel chromium alloy powders sintered with 17 1/2% by volume of alumina or titanium carbide.

Ferrous Metals

Battelle Memorial Inst., Columbus, O.
HYDROGEN EMBRITTLEMENT OF PLATED STEEL SPRINGS, by J.A. Gurklis, L.D. McGraw, and C.L. Faust. Final rept. for 15 Dec 55-15 Dec 56 on Contract DA 36-039-sc-70167. Dec 56, 46p.
Order from OTS $1.25 PB 151 125

This study demonstrated that random variation in the susceptibility of spring steel to hydrogen embrittlement is as large as the embrittling effect of cleaning and cadmium-plating treatments which avoid acid pickling and cathodic cleaning and pickling. With reasonable care and precautions taken in cleaning and plating, no subsequent heat-treating cycle or other embrittlement relieving treatment after plating is needed for cadmium-plated steel springs.

Metals Research Lab., Carnegie Inst. of Tech., Pittsburgh, Pa.
INVESTIGATION OF LOW TEMPERATURE TOUGHNESS IN ORDNANCE STEEL, by C. Wells, W.B. Triplett and others. Interim technical rept. on Contract DA 36-061-505-ORD-540. Oct 57, 101p. 34 refs. WAL 310/204-1.
Order from LC mi $5.70, ph $16.80 PB 135 323

The Charpy V-notch impact test, when properly used, is reproducible. Nonmetallic inclusions and segregation, considered together, are a major cause of abnormally high impact variation within plate. Of three specially deoxidized ingots, the one treated with rare earths had superior toughness (resisted crack initiation and crack propagation most effectively), the second treated with Ca-Si had intermediate toughness, and the third treated with Zr-Si had least toughness.

Naval Research Lab., Washington, D.C.
CRACK PROPAGATION TESTS OF SOME HIGH-STRENGTH SHEET STEELS, by J.E. Srawley and C.D. Beachem. 10 Jan 59, 26p. 4 refs. NRL rept. 5263.
Order from OTS $0.75 PB 151 352

The results of crack propagation tests using 1/2-inch-wide center-cracked tensile specimens are presented for eight different high-strength sheet steels. In each case the net fracture stress and the fracture appearance, in terms of the percentage of the thickness of the specimen occupied by the shear borders, are exhibited as a function of testing temperature over a suitable range to include the transition from brittle to tough behavior. The conventional ultimate and yield tensile strengths are given over the same range for comparison. The fracture-appearance transition temperature is defined as the lowest temperature at which a specimen would exhibit an entirely shear fracture, and the net fracture-stress transition temperature is arbitrarily defined as the lowest temperature at which the net fracture stress would equal the yield strength. A tentative criterion for evaluation of materials is suggested: that the fracture-appearance transition temperature must not exceed the lowest temperature of operation of the intended application if the risk of brittle failure is to be minimized. The fracture-appearance criterion has the advantage that it is a feature which can usually be readily determined for all types of test and service failures. The process of fracturing for this type of specimen is conjectured and its bearing upon the value of the net fracture stress discussed. Limited information is given on the effect of heat treatment for a given steel in a given thickness, and on the effect of thickness for a given steel in a given condition. For some steels, if the width-to-thickness ratio is too low (about 5 or less), the net fracture-stress values above the transition temperature are unreliable and indicate that the material should be tested again using wider specimens. Only two steels were found to have a combination of room-temperature yield strength in excess of 200 ksi with fracture-appearance transition temperatures at or below room temperature. One was proprietary low-alloy steel (0.083 inch thick) and the other a "semiaustenitic" precipitation hardening steel (0.10 inch thick). Further testing of these two steels, using wider specimens and also specimens with their major axes transverse to the direction of rolling, is desirable. Some results are given in appendix which show that there is good agreement between the net fracture-stress values obtained by using specimens cracked by hydrogen embrittlement and straining, and those cracked by fatigue stressing.

Zapffe, Carl A., Baltimore, Md.
SENSITIVITY OF DIFFERENT STEELS TO PICKLING BRITTLENESS, by C.A. Zapffe and M.E. Haslem. [Contract N6onr-258(02)] [1948] 27p. 8 refs. AD-137 777.
Order from LC mi $2.70, ph $4.80 PB 136 226

The susceptibilities of various steels to pickling brittleness are: (a) In cathodic pickling, annealed steel is least susceptible, hardened steel most; and coldwork further increase the susceptibility. Among the stainless steels, the thermally hardenable (martensitic) grades are the most susceptible to hydrogen embrittlement. Increasing carbon content increases the susceptibility. (b) In acid pickling, with the exception of 440-c, the stainless steels are less susceptible to embrittlement.

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF A HEAT TREATABLE TITANIUM SHEET ALLOY, by C. Robert Lillie and David W. Levinson. Rept. for 1 Jan 56-31 Dec 57 on Metallic Materials, Contract AF 33(616)3320. Aug 58, 93p. WADC Technical rept. 58-183; AD-155 796.
Order from OTS $2.25 PB 151 279

The objective of this research program was to develop heat treatable titanium sheet alloys capable of providing 160,000 psi yield strength, 0.2% offset, at room temperature. The material should be easily rolled to light gages, of the order of 0.020 in., possess excellent formability in the solution-treated condition, and be stable under stress, as heat treated, for at least 500 hours at 600° and 800°F. Good weldability was secondary in desirability to the foregoing requirements. Two alloys, Ti-3Al-7Mo-0.25Be and Ti-2.5Al-7Mn, reasonably fulfilled the objectives of the program with regard to bend properties and tensile properties.

Armour Research Foundation, Chicago, Ill.
PHASE RELATIONSHIPS IN BINARY MAGNESIUM ALLOYS, by Rodney P. Elliott, John K. Koeneman, and Arthur G. Metcalfe. Final rept. 24 Aug 56-30 Apr 57 on Contract DA 11-022-ORD-1975. 19 Aug 57, 37p. 13 refs.
Order from LC mi $3.00, ph $6.30 PB 136 176

Partial binary phase diagrams of magnesium with titanium, -zirconium, -manganese and -hydrogen have been investigated by resistivity methods. The magnesium-titanium system has a 200°C solubility of 0.00057% Ti. In the magnesium-manganese system, solubility limits ranged from 0.03 wt% at 200°C to 1.82 wt% at 640°C. At one atmosphere pressure hydrogen solubilities are 32.5, 46.0, 60.5, and 63.5 cc/100 gm at STP at 640°, 675°, 725°, and 775°C, respectively.

Armour Research Foundation, Chicago, Ill.
PILOT PRODUCTION OF PROMISING ELEVATED TEMPERATURE TITANIUM-BASE ALLOYS, by Donald J. McPherson. Rept. for 1 May 53-31 Mar 55 on Metallic Materials, Contract AF 33(616)2060. Feb 56, 76p. WADC Technical rept. 54-546; AD-91 223.
Order from LC mi $4.50, ph $12.30 PB 136 558

Ingots weighing up to 113 pounds and up to 6 inches in diameter were cast in titanium-base alloys: (1) 6% aluminum, (2) 6% aluminum- 4% vanadium, (3) 6% aluminum-0.5% silicon, and (4) 7% aluminum-3% molybdenum. 6% Al alloy was found to possess good creep resistance, good weld bend characteristics and satisfactory fatigue properties. With a load of 40,000 psi at 800°F for 300 hours, a creep extension 0.08% was obtained. An as-welded bend ductility of 3.5 T and endurance limits of 55,000 and 60,000 psi were found.

Case Inst. of Tech., Cleveland, Ohio.
EFFECT OF ALPHA-BETA RATIO ON PROPERTIES OF TITANIUM ALLOYS, by R.J. Quigg, E.L. Harmon, Jr. and A.R. Troiano. Rept. on Contract DA 33-019-505-ORD-6. Aug 57, 77p. WAL rept. no. 401 93-37.
Order from LC mi $4.50, ph $12.30 PB 135 324

The final properties attainable by the heat treatment of titanium-base alloys are dependent upon the following factors: 1. The quantity and composition of the metastable beta phase retained by quenching.. 2. The type, amount, and configuration of the transformation products induced by aging.

Horizons, Inc., Cleveland, Ohio.
MECHANISM OF CRYSTAL GROWTH FROM ELECTROLYSIS IN MOLTEN SALT SYSTEMS, by Anthony J. Kolk, Quentin H. McKenna, and Merle E, Sibert. Final progress rept. on Contract Nonr-1178(00). July 55, 87p. 20 refs.
Order from LC mi $4.80, ph $13.80 PB 135 694

A detailed study of the process for the preparation of ductile titanium metal by electrolysis of a fused melt of NaCl and K_2TiF_6 has been completed. This research has been directed primarily towards the elucidation of the cathode mechanism and the mechanism of crystal growth. The investigation followed three general approaches: the study of the numerous process variables, crystallographic and physical evaluation of the metal produced, and a theoretical and experimental attack which involved specific conductance measurements and the voltammetric study of the electrode reactions in the system $NaCl-K_2TiF_6$.

Lubrication Lab., Mass. Inst. of Tech., Cambridge.
FRICTIONAL PROPERTIES OF TITANIUM AT HIGH TEMPERATURES, by E. Rabinowicz and E.P. Kinsbury. Final rept. for 1 July 56-30 June 57 on Contract DA-19-ORD-3471. Oct 57, 26p. 21 refs.
Order from LC mi $2.70, ph $4.80 PB 135 696

An experimental study of behavior of certain solid film lubricants on titanium surfaces at high temperature, metallic wear as a function of temperature in which the behavior of titanium is compared with other metals, thermal desorption of a boundary lubricant from metallic surface.

Massachusetts Inst. of Tech., Cambridge.
LOW-CYCLE FATIGUE OF NOTCHED AND UNNOTCHED SPECIMENS OF 2024 ALUMINUM ALLOY UNDER AXIAL LOADING, by Theodore H. H. Pian and Richard D'Amato. Rept. for 1 Aug 56-31 Oct 57 on Structural Design Criteria, Contract AF 33(616)3310. Feb 58, 87p. 24 refs. WADC Technical note 58-27; AD-142 307.
Order from OTS $2.25 PB 151 355

A review was made of the results that have been published of experimental and theoretical

investigations of low-cycle fatigue phenomena. Two experimental programs were conducted using 2024 aluminum alloy, one with notched sheet specimens with theoretical elastic stress concentration factors of 2.0, 2.5, and 4.0, the other with unnotched round specimens. For the notched specimens it was found that a straight line relationship existed between the range of strain measured at the edge of the notch and the number of cycles to failure when these variables were plotted on log-log scales. This straight line relationship was also found to describe the unnotched specimen test data. In addition, for the unnotched specimen results, an interaction diagram was constructed with range of strain as the ordinate and mean strain as the abscissa with cycles to failure as a parameter. With the aid of this diagram the fatigue behavior near ultimate load is discussed.

New York U. Coll. of Engineering, N.Y.
DEVELOPMENT OF ACTIVE-EUTECTOID BASE ALLOYS, by R.F. Bunshah and H. Margolin. Rept. for 1 Jan-31 Dec 57 on Metallic Materials, Contract AF 33(616)3942. Oct 58, 51p. 12 refs. WADC Technical rept. 58-328; AD-202 501.
Order from OTS $1.50 PB 151 518

Titanium-copper alloys form an active eutectoid titanium alloy system in which the decomposition of the beta phase to alpha plus compound occurs rapidly. This alloy development program is a study of the effect of stepwise additions of Al and/or Sn and/or Zr to binary Ti-2Cu, Ti-4Cu, and Ti-6Cu alloys. The alloys were forged as far as possible in the $\alpha\beta$ field and annealed at 750°C for 24 hours to alpha plus compound. The alloys were evaluated by tensile tests at room and elevated temperatures. Limited stress-rupture and stability tests were also carried out. Several alloys showed excellent tensile properties particularly in the range 1000 to 1200°F. These alloys show promise of utility in the 1000 to 1200°F range. Instability apparently associated with the Ti-Al phases was encountered.

North American Aviation, Inc., Downey, Calif.
STATUS OF TITANIUM ALLOY DEVELOPMENT PROGRAM, by J.G. Beerer. Progress rept. no. 10 on Contract AF 33(600)28469. Mar 55, 23p. Rept. no. AL-2064-9.
Order from LC mi $2.70, ph $4.80 PB 135 548

New data on the mechanical properties of Ti-5Al-2Mn are reported. The room temperature properties obtained were as follows: 148,000 psi U.T.S., 140,000 psi Y.S., 6-12 percent elongation. The 700 F mechanical properties were good: 95,000 psi U.T.S., 80,000 psi Y.S. for the mill annealed condition. Vacuum annealed properties were slightly lower. A new experimental complex titanium alloy Ti-3Al-1FeCr-1FeMo melted and processed by Titanium Metals Corporation was received and evaluated.

Worcester Pressed Steel Co., Mass.
EVALUATION OF DRAWABILITY OF TITANIUM, by James W. Hillhouse and Frank Larson. Final rept. on Contract DA 19-020-ORD-2331. 1956, 101p.
Order from LC mi $5.70, ph $16.80 PB 136 721

Materials tested were Commercially Pure Titanium alloy C-110M containing 8% manganese, and alloy A-110AT containing 5% aluminum and 2-1/2% tin. The program included variation of gauge of material, speed of the draw punch, temperature of material and draw dies, and diameter of material blanks being tested. The hydraulic draw press gave a constant draw speed from 5 to 6 feet per minute down to under 1 foot per minute.

Nonferrous (except light) Metals

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
MAGNETIC EXAMINATION OF THE INITIAL PRECIPITATION IN A GOLD-NICKEL ALLOY, by Ami E. Berkowitz and Philip T. Flanders. Final progress rept. on Contract Nonr-1556(00). May 57, [39]p. 18 refs. Rept. no. F-2482.
Order from LC mi $3.00, ph $6.30 PB 135 083

The magnetic measurements include the field and temperature dependence of the saturation magnetization, torque, rotational hysteresis, and remanence. The structural properties of the precipitate particles derived from these measurements are shape and size distributions, degree of precipitation, coherency, and orientation. The temperature dependence of the magnetic properties also reflected the shape dependence of the mechanism of magnetization.

Utah U., Salt Lake City.
HIGH TEMPERATURE OXIDATION OF METALS, by W. Martin Fassell, Jr. Progress rept. nos. 1-3 onCContract DA 04-495-ORD-237. 1952, 3 nos.
Order from LC

Experimental studies on the oxidation of tantalum and zirconium.
Progress rept. no. 1, 1 Dec 51-29 Feb 52, 11p. mi $2.40, ph $3.30, PB 135 709
Progress rept. no. 2, 29 Feb-1 June 52, 11p. mi $2.40, ph $3.30, PB 135 710
Progress rept. no. 3, 1 June-26 Sep 52, 12p. mi $2.40, ph $3.30, PB 135 711.

Structural Metallurgy and Corrosion

California Inst. of Tech., Pasadena.
ELECTRON PROBE FOR LOCAL ANALYSIS BY MEANS OF X-RAYS, by David B. Wittry. Interim technical rept. no. 5, on The Design and Development of an Electronic X-ray Probe for the Study of Alloys and of the Structure of Metals, Contract

Da 04-495-ORD-463. 192p. 54 refs.
[WAL-142/59-9].
Order from LC mi $8.70, ph $30.30 PB 135 429

Detroit Arsenal, Center Line, Mich.
MICRORADIOGRAPHY, by Fred L. Seppi and Emil W. Fischer. 16 Aug 57, 24p. 13 refs. Rept. no. 3598 (Second).
Order from LC mi $2.70, ph $4.80 PB 136 206

A new method of preparing samples for microradiographic examination was devised which is less time consuming, less expensive, and more accurate. The distribution and qualitative analysis of the alloying elements in certain lamellar inclusions appearing in rolled armor and the grain boundary network within a fusion welded zone were deter mined. Microradiographs of rolled armor and welded sections were compared to photomicrographs.

Engineering Research Inst., U. of Michigan, Ann Arbor.
AN INVESTIGATION OF THE RELATIONSHIP BETWEEN MICROSTRUCTURE AND CREEP-RUPTURE PROPERTIES OF HEAT-RESISTANT ALLOYS, by A. Phillip Coldren and James W. Freeman. Rept. for Dec 56-Mar 58 on Metallic Materials, Contract AF 33(616)3239. July 58, 71p. 13 refs. WADC Technical rept. 58-204; AD-155 711.
Order from OTS $2.00 PB 151 421

Progress is reported on an investigation of the influence of conditions of hot working on the properties of alloys at high temperatures. Conditions of working can be used to control microstructural variations in a manner which cannot be obtained in any other procedure and is capable of developing structures superior in properties to any other treatment. The major objective is to define the basic principles involved so that they can be applied to the general problem of developing optimum properties in any alloy. The relatively simple structure of "A" Nickel is being used as an experimental material for study of the role of working for properties in the as-worked condition. A-286 alloy is being used as an example of a material whose properties are influenced after solution and aging treatments by the conditions of prior working. The results reported cover the initial surveys of the relationships of working conditions to creep and rupture properties. Structural analyses to define the basic principles involved were confined to preliminary partial studies. The investigation is being continued with emphasis on the structural studies.

National Advisory Committee for Aeronautics, Washington, D.C.
EFFECT OF PRECIPITATE PARTICLES ON CREEP OF ALUMINUM-COPPER ALLOYS DURING AGE HARDENING, by E.E. Underwood, L.L. Marsh, and G.K. Manning (Battelle Memorial Inst.)
Sep 58, 56p. 37 refs.
Order from NASA* NACA TN-4372

Spherical or platelike precipitates were prepared in aluminum alloys with 1 to 4 weight percent copper. The effects of controlled sizes and distributions of particles were determined by creep, tensile, and hardness measurements, by quantitative metallographic evaluation of the particle characteristics, and by X-ray and electron-microscope examinations. The importance of matrix composition in relation to alloy strength is shown. An unusual particle strengthening effect is found beyond a critical spacing of about 50 microns.

National Advisory Committee for Aeronautics, Washington, D.C.
INFLUENCE OF ALLOYING UPON GRAIN-BOUNDARY CREEP, by F.N. Rhines, W.E. Bond, and M.A. Kissel (Carnegie Inst. of Tech.). 1957, 8p. 2 refs. Supersedes NACA TN-3678, PB-120 258.
Order from GPO** $0.15 NACA rept. 1331

Grain-boundary displacement, occurring in bicrystals during creep at elevated temperature (350°C), was measured as a function of the copper content (0.1 to 3 percent) in a series of aluminum-rich aluminum-copper solid-solution alloys. Because alloying effects alone were to be investigated, the conditions of observation were limited to a single temperature and range of stress.

Rock Island Arsenal Lab., Ill.
VCI OILS: PROPERTIES AND PROPOSED QUALITY CONTROL TESTS, by Ralph L. LeMar. 19 June 58, 61p. 19 refs. Rept. no. 58-1603.
Order from OTS $1.75 PB 151 122

VCI oil formulations were subjected to various tests for both preservative oils and volatile corrosion inhibitors. Several new tests were developed to evaluate special properties of VCI oil. VCI oils were found to be effective for inhibiting ferrous metal corrosion above the oil phase. Most VCI oils displayed other useful properties, as shown by satisfactory performance in the water displacement, hydrobromic acid neutralization and salt water immersion tests. These oils also showed some undersirable properties.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Army Medical Research Lab., Fort Knox, Ky.
SAFETY INTERLOCKING DEVICE FOR STABILIZING RADIATION SHEILDING WALLS, by Ray R.

*National Aeronautics and Space Administration, 1520 H Street, N.W., Washington 25, D.C.
**Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

Heer, Jr. 10 Feb 54, 9p. Rept. no. 138.
Order from LC mi $1.80, ph $1.80 PB 136 422

Described herein is an interlocking device for mechanically stabilizing multi-thickness multi-tiered lead brick walls. The device consists of a flat steel plate 7/8" x 1/2" x 3/16" with two 1-11/16" steel rods press fitted into the plate. These rods fit into holes which are drilled in the bricks, the holes being placed in such a way that the device does not appreciably reduce the radiation protection ability of the wall. All popular type bricks are easily adapted to the device.

Western Researve U., Cleveland, O.
ROTATIONAL MAGNETIC MOMENT OF H_2, by G.E. Tauber. Rept. on Contract AF 18(603)61. 8 July 58, 17p. AFOSR TN-58-571; AD-158 390.
Order from LC mi $2.40, ph $3.30 PB 135 993

The rotational magnetic moment of H_2 has been calculated by considering the motion of the electrons in the presence of the two nuclei which are permitted to move themselves. The interaction is described by Breit's two-body Hamiltoniam suitably generalized to this problem. The wave function is obtained by the Born-Oppenheimer method of adiabatic approximation. Calculations have been carried out for Wang's electronic wave function and up to first order in the expansion parameter give for the effective magnetic field due to rotation 23.6 gauss in good agreement with the experimental results of 27.0 gauss.

Nuclear Engineering and Power

Ecole Normale Supérieure (France)
TECHNICAL REPT. OCTOBER 1, 1956-SEPTEMBER 30, 1957 ON CONTRACT AF 61(514)1061. 63p. 27 refs. AFOSR TN-57-745; AD-106 732.
Order from LC mi $3.90, ph $10.80 PB 136 210

Effects of Proton Correlations on the Scattering of High-Energy Electrons from Nuclei, by L.I. Schiff.
Theory of High-Energy Potential Scattering, by D.S. Saxon and L.I. Schiff.
On the Validity of Levinson's Theorem for Non Local Interactions, by A. Martin.

Floyd Newman Lab. of Nuclear Studies, Cornell U., Ithaca, N.Y.
CORNELL BEV SYNCHROTRON, by Robert R. Wilson. Rept. on Contract Nonr-401(26). Dec 56, 83p. 9 refs.
Order from LC mi $4.80, ph $13.80 PB 137 054

The new Cornell synchrotron was designed to accelerate electrons to an energy of about 1.5 Bev. It was desirable that the synchrotron be small enough to go into an existing building, that it be constructable using a small machine shop, that it be relatively inexpensive (a few hundred thousand dollars), and that it utilize the power equipment of the already-existing 300 Mev synchrotron, i. e. a 30-cycle alternating current generator, a condenser bank, control circuits, etc. The construction of the new machine was to be carried out in such a manner that the old machine could be kept running until the new machine gave a beam of comparable energy.

Naval Research Lab., Washington, D.C.
NAVAL RESEARCH LABORATORY RESEARCH REACTOR. PART VIII. NEUTRON FLUX MEASUREMENTS AND POWER DETERMINATION, by E.H. Bebbs and H. Caly Price, Jr. 28 Nov 58, 48p. 24 refs. NRL rept. 5196.
Order from LC mi $3.30, ph $7.80 PB 134 548

Measurements have been made of the thermal and epicadmium neutron flux distribution in the NRL Research Reactor for a number of core configurations. A power determination based on the flux measurements for a graphite-water reflected core has been made. Foils of 10% indium-90% aluminum, 1/8 in. in diameter and 0.010 in. thick, and gold foils 1 cm^2 in area and 0.001 in. thick, were used as detectors. The use of the very small In-Al foils and commensurately small cadmium boxes permitted extensive foil loading without appreciably affecting the reactivity. Corrections for the attenuation of the neutron flux in the cadmium containers and for the thermal activation of cadmium-covered foils were obtained in auxiliary experiments. These experiments are being refined, and more precise results will be published later.

Naval Research Lab., Washington, D.C.
SOME RECENT ADVANCES IN RADIOACTIVE SELF-LUMINOUS AIDS TO NIGHT MILITARY ACTIVITY, by L.J. Boardman. Interim rept. 19 Dec 58, 12p. 6 refs. NRL rept. 5241.
Order from OTS $0.50 PB 151 226

The characteristics and properties of some recently developed radioactive self-luminous sources of light excited by the radioactive isotope krypton-85 are described. Of particular interest are the railway switch light, the hand lanterns, and flashlights. These are simple, rugged, long-life sources which do not depend upon complicated sources of power that may fail at critical times. The ability of the eye when fully dark adapted to read or work in a dark room with these sources of light has been determined, also, the distances that the sources are visible in the dark, the limit of visibility of the brightest being about 2500 feet. Radioactive hazards are discussed and shown to be negligible.

Nevis Cyclotron Labs., Columbia U., Irvington-on-Hudson, N.Y.
CYCLOTRON CONSTRUCTION REPORT, by E.T. Booth, M.W. Johnson and others. Rept. on Contract N6ori-110(01). 30 Mar 50, 54p. ATI-174 421.
Order from LC mi $3.60, ph $9.30 PB 137 055

Oklahoma A. and M. Coll. School of Electrical Engineering, Stillwater.
UNCONVENTIONAL ELECTRICAL POWER SOURCES, by Paul A. McCollum. Rept. on Electrical Generation Equipment, Contract AF 33(616) 2237. Sep 57, 38p. 15 refs. WADC Technical rept. 54-509, pt. 4 AD-142 321.
Order from LC mi $3.00, ph $6.30 PB 137 089

Radioactivity

Goodrich, B.F., Co., Brecksville, Ohio.
STUDY OF THE EFFECTS OF NUCLEAR RADIATIONS ON ELASTOMERIC COMPOUNDS AND COMPOUNDING MATERIALS, by John W. Born, Dwain E. Diller, and Eugene H. Rowe. Rept. for 1 Jan-31 Dec 56 on ANPP Development Support Project, Contract AF 33(616)2308. June 57, 45p. 3 refs. WADC TR-55-58, pt. 3; AD-130 803.
Order from LC mi $3.60, ph $9.30 PB 136 237

The effort to define, understand, and prevent radiation damage to rubber continued during 1956. Research followed four main lines: the development of Anti-Rads to prevent radiation damage; infrared and mass spectral analyses to relate radiation stability to molecular structures of elastomers; stress relaxation studies to define the mechanisms of radiation damage; and measurements of dynamic mechanical properties of representative rubber compounds after irradiation. Emphasis upon applied testing of end-materials increased. The best Anti-Rad extended the retention of tensile strength and ultimate elongation by natural rubber tread stock more than tenfold. The screening study is providing criteria for the selection of superior Anti-Rads. A new technique of mass spectral analysis promises to aid greatly in determining what molecular structural features impart radiation stability. Stress relaxation measurements detail the important role of oxygen in radiation damage. Dynamic test data are give for eight representative rubber compounds.

Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.
NUCLEAR SHIELDING STUDIES. V. COMPUTATION OF RADIATION SHIELD THICKNESS BY THE MONTE CARLO METHOD, by S.W.W. Shor. Technical rept. no. 32 on Contract N5ori-078(18). 1 Jan 50, 90p.
Order from LC mi $4.80, ph $13.80 PB 136 427

By application of statistical sampling concepts to the Monte Carlo method, two procedures for computing neutron attenuation through very thick shields are developed in this report.

Naval Research Lab., Washington, D.C.
RADIOCHEMICAL ANALYSES OF AIR-FILTER SAMPLES COLLECTED DURING 1957, by R.A. Baus, R.L. Patterson, Jr. and others. Interim rept. 31 Dec 58, 19p. 7 refs. NRL rept. 5239.
Order from LC mi $2.40, ph $3.30 PB 136 286

The results of sequential radiochemical analyses for some high-yield fission elements collected by air filters during 1957 at sites along the 80th meridian (west) and at several other sites in the Northern Hemisphere are reported. Particularly noteworthy is the large excess of the long-lived radioisotopes Sr^{90} and Cs^{137} at all locations, which leads to apparent ages of the fission debris that are considerably longer than the expected lifetime of this material in the lower atmosphere. The apparent age of the fission debris is much greater south of the Equator as would be expected if stratospheric mixing occurs. Further, the ratio of the Cs^{137} to Sr^{90} activity in the air is around 2 at all sites regardless of latitude or apparent age of the fission debris collected.

Ordnance Materials Research Office, Watertown, Arsenal, Mass.
REPORT OF CONFERENCE ON EFFECTS OF NUCLEAR RADIATIONS ON MATERIALS, AT WATERTOWN ARSENAL, 1 and 2 OCTOBER 1957. Feb 58, 85p. 23 refs. Pub. no. 13A.
Order from OTS $2.25 PB 151 001

This report includes the agenda, abstracts, and the following papers presented at the Second Ordnance Corps Conference on Nuclear Energy Applications: Analysis of activated spectroscopic copper, by David U. Wright, Jr. Analysis of activated blast gage components, by David U. Wright, Jr. The effect of nuclear radiation on lubricants, by H. Gisser. High energy radiation in the field of plastics, by J.D. Matlack. The effects of x-radiation on the optical properties of quartz crystals, by G. Arutunian and O. Renius. Gamma-ray induced coloring of potassium azide, by J.E. Mapes and R.W. Dreyfus.

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DEVELOPMENT OF AN IMPROVED AIR FORCE SUNGLASS, by Jerome A. Hirsch. Rept. on Visual Aids and Protection. Aug 58, 14p. WADC Technical rept. 58-278; AD-155 843.
Order from OTS $0.50 PB 151 490

The factors which rendered the F-2 and G-2 sunglasses unacceptable are briefly discussed. The experimental sunglass, designed for service testing, is described. Improvements resulting from field usage leading toward the ultimate standardization of a new sunglass, the HGU-4/P, are presented. A complete summary of improvements included in the new specification are outlined.

Navy Clothing and Textile Office, Brooklyn, N.Y.
DEVELOPMENT AND EVALUATION OF WATER-

PROOF TWO-WAY STRETCH LAMINATED FABRICS, by Robert Briganti and Peter Sylvia, Jr. Rept. on Shipboard Immersion and Rescue Suits. Apr 58, 23p. 8 refs. Research and Development Rept. no. 21.
Order from OTS $0.75 PB 151 034

The development and evaluation of laminated waterproof, two-way stretch swim suit fabrics are discussed. These fabrics are evaluated against currently available waterproof materials having stretch properties in only one direction. This report covers a detailed analysis of laboratory tests of the component fabrics, with a short summary of service evaluations of finished garments.

Polacoat, Inc., Blue Ash, Ohio.
ULTRAVIOLET AND NEAR INFRARED ABSORPTIVE COATING MATERIALS AND TECHNIQUES FOR THEIR APPLICATION, by Donald H. Baltzer and John F. Dreyer. Rept. on Visual Aids and Protection, Contract AF 33(616)5146. Aug 58, 11p. WADC Technical rept. 58-73; AD-203 902.
Order from OTS $0.50 PB 151 481

Coating techniques and materials for the manufacture of uniform density plastic prescription sunglasses have been investigated. Coating by a spinning technique using a formulated nitrocellulose compound was found to give the best results. The properties of the final coated lens include a daylight transmittance of 15%±3; neutrality represented by chromaticity coordinates: $x = 0.37$, $y = 0.36$; ultraviolet cut off at 390 millimicrons; near infrared spectral transmittance below 50% between 700 and 1200 millimicrons; good resistance to paper scratching with a pencil hardness of 2H to 3H.

Navy Clothing and Textile Office, Brooklyn, N.Y.
DEVELOPMENT OF INTERNALLY SUPPORTED VINYL FILMS FOR USE IN IMMERSION SUITS. PHASE I: RELATIONSHIP OF FABRIC STRUCTURE AND FILM THICKNESS TO THE PHYSICAL PROPERTIES OF INTERNALLY SUPPORTED VINYL FILMS, by Jack Naimer. Rept. on Shipboard Immersion and Rescue Clothing. Apr 58, 12p. 2 refs. Research and Development Rept. no. 25.
Order from LC mi $2.40, ph $3.30 PB 135 968

A laboratory evaluation was conducted on internally supported vinyl films developed for use in immersion suits. The effects of variations in fabric texture and film thickness on the physical properties of the laminated fabrics are discussed.

Psychological Services, Inc., Los Angeles, Calif.
A FACTOR ANALYSIS OF RATING SCALE VARIABLES USED AS CRITERIA OF MILITARY LEADERSHIP, by N.E. Willmorth, E.L. Taylor and others. Rept. on Contract AF 18(600)468. Dec 57, 59p. 10 refs. AFPTRC TN 57-154; AD-152 118.
Order from LC mi $3.60, ph $9.30 PB 135 944

Peer ratings of anticipated leadership on a scale covering 34 aspects of effective leadership and on an over-all leadership ranking were obtained for 317 officers attending the Squadron Officers Course at Maxwell Field, Alabama. An intercorrelation matrix derived from these leadership ratings and factual data on rank, age, education, and years of service was factor analyzed by Thurstone's complete centroid method. The seven factors obtained were rotated orthogonally to the criteria of positive manifold and simple structure. Six interpretable factors were tentatively identified as proficiency in administrative activity, military service, interpersonal relations, responsibleness, ethical officer conduct, and command presence. Regression weights of the items for the factors were determined as well as the intercorrelations and reliabilities of the six factors indentified.

Quartermaster Research and Engineering Center, Natick, Mass.
PHYSIOLOGY OF LOAD CARRYING XIV. EVALUATION OF ARMY COMBAT PACKS BY MEASURING ENERGY COSTS AND SPEED OF MOVEMENT, by Eng-Hauw Tan, Creighton J. Hale, and Peter V. Karpovich. Oct 57, 20p. Technical rept. EP-71.
Order from LC mi $2.40, ph $3.30 PB 136 219

The energy cost and speed of executing six performance tests were used as criteria for evaluating the U.S. Standard, U.S. Experimental, and British Experimental combat packs. A subjective rating based on comfort and freedom from interference with movements was also included for this evaluation. Tests of running, creeping, jumping, rolling, climbing, and falling-and-getting-up were performed without a pack and with each of the three different packs. Ten subjects were used. Less energy was expended when activities were performed without a pack than with a pack. Nearly all tests were performed faster without a pack than with a pack. On the basis of energy cost and performance time of each test, none of the packs can be considered definitely superior to the others. According to the subjective rating, the U.S. Standard pack was the best, the U.S. Experimental pack second, and the British Experimental pack third.

Apparel

Antioch Coll., Yellow Springs, Ohio.
SIZING SYSTEM FOR HIGH ALTITUDE GLOVES, by James T. Barter and Milton Alexander (Aero Medical Lab.). Rept. on High Altitude Pressure Suits and Accessories, Contract AF 18(600)30. Dec 58, 28p. 3 refs. WADC Technical rept. 56-599; AD-110 589.
Order from LC mi $2.70, ph $4.80 PB 137 021

This report presents the rationale for and procedures followed in the development of a sizing program for high altitude gloves. This program is based on four divisions of hand circumference, each subdivided into three divisions of hand length making a total of twelve sizes. A selected sample of 100

hands was measured to provide the thirty-one dimensions presented for design purposes. Summary statistics, regression equations, design dimensions, and procurement tariff are presented in various tables throughout the report. The results of a fit-test of two differing styles of gloves sized according to this program indicate that a high percentage of personnel can be fitted adequately in their indicated size. Detailed instructions for determining the indicated size of gloves are also included.

Quartermaster Research and Engineering Center, Natick, Mass.
ENCUMBRANCE OF ARCTIC CLOTHING, by E. R. Dusek. Apr 58, 39p. 7 refs. Technical rept. EP-85.
Order from LC mi $3.00, ph $6.30 PB 135 113

The degree to which Arctic clothing restricts body movements was investigated in this study. Fifteen tests of performance were used; twelve of these tests were found to be sensitive to the restrictions imposed on the individual by clothing. Arctic clothing was found to be particularly restrictive on movements of the neck, shoulder, arm, waist and crotch. The results provide the clothing designer as well as the designer of Army equipment with information on the movement limits of the individual when wearing heavy Arctic clothing as well as when lightly clothed. These tests are useful to obtain specific information regarding the movements of body parts and to obtain evaluations of proposed design changes in clothing and equipment.

PHYSICS

Army Research Office, Washington, D.C.
ANNUAL RESEARCH TASK SUMMARY, 1959. VOLUME 3. PHYSICS (PART I). 349p.
Order from OTS $3.50 PB 151 496

Army Research Office, Washington, D.C.
ANNUAL RESEARCH TASK SUMMARY, 1959. VOLUME 4. PHYSICS (PART II) AND MATHEMATICS. 310p.
Order from OTS $3.00 PB 151 497

Institute of Mathematical Sciences, New York U., N.Y.
QUANTUM THEORY OF CHEMICAL REACTION RATES, by Ernest Bauer. Rept. on Contract AF 19(604)1705. Mar 58, 29p. Research rept. no. CX-33. AFCRC TN-58-260; AD-152 496.
Order from LC mi $2.70, ph $4.80 PB 135 233

The rate constants of chemical exchange reactions involving relatively light atoms were examined. Discussions are given of the formulation, the difficulties in calculating the potential energy, the activated state in the classical statistical theory, the quantum-mechanical model of the activated state, the quantum characteristics of the rate calculation, a sketch of possible methods of solution, and the effect of rotation.

New York U., N.Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallman. Progress rept. 1, Feb-Apr 55 Contract DA 36-039-sc-64526. Aug [55] 118p.
Order from LC mi $6.00, ph $18.30 PB 135 935

Contents:

Fluorescence of organic molecules in various solvents
Stimulation and de-excitation as function of wavelength and time
Investigations into trap distribution and non-radiative transitions

New York U., N.Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Progress rept. 2, May-July 55 Contract DA 36-039-sc-64526. Apr [56] 57 p. 20 refs.
Order from LC mi $3.60, ph $9.30 PB 135 934

Contents:

Fluorescence efficiencies of organic compounds
Scintillating solutions containing heavy elements
(See also PB 135 935)

New York U., N.Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Progress rept. 3, Aug-Oct 55 Contract DA 36-039-sc-64526. Apr [56] 73p.
Order from LC mi $4.50, ph $12.30 PB 135 933

Contents:

The process of light stimulation on ZnCdS phosphors
Photoconductivity in various ZnCdS phosphors
(See also PB 135 934)

New York U., N.Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Progress rept. 5, Feb-Apr 56 Contract DA 36-039-sc-64526. Aug [56] 65p. 15 refs.
Order from LC mi $3.90, ph $10.80 PB 135 932

Contents:

Energy transfer in liquid organic systems
Further investigations of A.C. photoconductivity on phosphor LG
(See also PB 135 933)

New York U., N.Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Progress rept. 6, May - July [56] Contract DA 36-039-sc-64526. Sep 56, 84p. 2 refs.
Order from LC mi $4.80, ph $13.80 PB 135 931

Contents:

Quenching effects on organic fluorescence
A.C. photoconductivity measurements
A.C. photoconductivity measurements at reduced temperature
(See also PB 135 932)

New York U., N.Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Progress rept. 7, Aug-Oct [56] Contract DA 36-039-sc-64526. Dec 56, 86p. 20 refs.
Order from LC mi $4.80, ph $13.80 PB 135 930

Contents:

Energy transfer in plastics
The effect of strong dc fields on the ac photoconductivity of ZnS and ZnCdS powder phosphors
(See also PB 135 931)

New York U., N.Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Quarterly rept. 1, Feb - Apr [57] Contract DA 36-039-sc-73145. July 57, 78p. 15 refs.
Order from LC mi $4.50, ph $12.30 PB 135 752

Contents:

Energy transfer in liquid solutions under light and high energy excitations.
Energy transfer in plastics (3).
The effect of externally applied dc and ac fields on the ac photoconductivity of ZnS and ZnCdS power phosphors (3).
Note on the effect of externally applied fields on the trap occupation distribution in ZnS and ZnCdS phosphors.
(See also PB 135 930)

New York U., N.Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Quarterly rept. 2, May-July [57] Contract DA 36-039-sc-73145. Oct 57, 110p.
Order from LC mi $5.70, hh $17.80 PB 135 753

Contents:

Fluorescence of solutions with two solutes
Electroluminescence and electrophotoluminescence
(See also PB 135 752)

New York U., N.Y.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA, by Hartmut Kallmann. Quarterly rept. 3, Aug-Oct [57] Contract DA 36-039-sc-73145. Jan 58, 81p. 16 refs.
Order from LC mi $4.80, ph $13.80 PB 135 754

Contents:

Energy transfer in plastics (4)
AC impedance measurements of copper activated AnS and ZnCdS phosphors at liquid nitrogen temperatures
(See also PB 135 753)

Acoustics

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ACOUSTICAL EVALUATION OF THE F4D NOISE SUPPRESSION RUN-UP HANGAR AT DOUGLAS, EL SEGUNDA, by Lothar O. Hoeft. Rept. on Reception, Transmission and Reduction of Acoustical Energy by Structures, Sep 58, 32p. WADC Technical note 58-112; AD-203 644.
Order from OTS $1.00 PB 151 477

This report describes the acoustical characteristics of the F4D run-up hangar at Douglas Aircraft Company, El Segundo, California. Measurements in three areas are presented: (1) on a circle of 250 foot radius with the engine at military power; (2) around the outside of the run-up hangar with the engine at military power: (3) inside the hangar with the engine at idle power. These measurements indicate that at 250 feet this noise suppressor had an average reduction above 300 cps of about 29 db. Some aerodynamic measurements and comments on the construction are included in this report.

Bolt, Beranek, and Newman, Cambridge, Mass.
ACOUSTICAL EVALUATION OF B-58 RUN-UP PEN AT CONVAIR-FORT WORTH, by N. Doelling and K.S. Pearsons. Rept. on Reception, Transmission and Reduction of Acoustical Energy by Structures, Contract AF 33(616)3938. Oct 58, 63p. 4 refs. WADC Technical note 57-389: AD-142 160.
Order from OTS $1.75 PB 151 501

This report describes the acoustical evaluation of the run-up pen with the B-58 at CONVAIR - Fort Worth. Data are presented which show that the noise reduction in forward quadrants in of the order of 20 or 30 decibels while in the aft quadrants it is about 0 db. This pen provides hearing protection to personnel located in adjacent pens. The noise characteristics of the B-58 are also presented.

Electronics Research Lab., Northeastern U. Boston, Mass.
SPEECH ANALYSIS, by S.H. Chang, J. Wiren and others. Scientific rept. no. 1, 15 Jan-30 June 58, on Contract AF 19(604)3465. 39p. 12 refs. AFCRC

TN-58-181; AD-152 429.
Order from LC mi $3.30, ph $7.80 PB 135 963

This report summarizes speech analysis studies. Chapter I describes the recent improvements in the Formoder, an experimental speech-band compression system, and tests designed to evaluate the relative importance of the parameters of the system. Chapter II describes a comparative evaluation of the Formoder and the Melpar Speech Compression System. The similarities in principle and performance of the two systems are reported. It is also recommended that in order to equal or exceed the performance of the modern 18-channel Vocoder with less channel capacity the systems based upon the dynamic model should incorporate in its principle the recognition of certain phonemic features. Chapter III deals with a plan for the digitalization of the parametric signals for the purposes of (1) determining the rate of information, (2) multiplexing of the parametric channels, and (3) using digital computers for speech analysis.

Electricity and Magnetism

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THE EFFECT OF FLUX DISTRIBUTION ON IRON LOSSES, by M.J. Schindler. June 58, 28p. 3 refs. WADC Technical note 58-174; AD-203 785.
Order from OTS $0.75 PB 151 502

The classical formula used to compute eddy current losses in magnetic sheet steel is derived from Maxwell's field equations based on the conditions of constant permeability. This condition of constant permeability is unfounded since in each cycle the permeability of modern materials will undergo changes of at least one to one hundred. Large differences between actual losses and the losses computed according to the classical formula have been noted. These differences could be attributed to the assumption of constant permeability. This paper attempts to determine approximate solutions for Maxwell's field equations under the condition of variable permeability that will lead to a modified formula for determining the eddy current losses. Since rough approximations were used final conclusions cannot be made. However, the results indicate that the error in the classical formula (the assumption of constant permeability) accounts for only a small part of the discrepancy between calculated and actual eddy current losses. Experiments were conducted that confirmed the concept of changing flux distribution. These experiments also indicated that other mathematical approaches could be used for more accurate approximations.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
MAGNETIZATION MECHANISM OF MULTIDOMAIN PARTICLES, by Henri Amar. Interim rept. 1 Mar 57-28 Feb 58 on Solid State Research and Properties of Matter, Contract AF 33(616)5041. Mar 58, 28p. 9 refs. Rept. no. I-A2033-1; WADC Technical rept. 58-134; AD-155 764.
Order from OTS $0.75 PB 151 420

The free energy of a two-domain single crystal cube of iron is considered with and without an applied magnetic field. In the absence of a field, the two-domain configuration may exist only beyond a definite critical size (200 A), the wall characteristics are size dependent, and their values are substantially different from the values calculated for bulk material. The displacement of the wall in the presence of an applied field is considered, and it is found that magnetization by wall motion is a hard process, contrary to the case of bulk material.

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
PREPARATION OF FERROMAGNETIC FINE PARTICLES FROM BIMETALLIC OXALATES, by William J. Schuele. Interim rept. for 1 Mar 57-28 Feb 58, on Solid State Research and Properties of Matter, Contract AF 33(616)5041. Apr 58, 16p. 13 refs. Rept. I-A2033-2 WADC Technical rept. 58-135; AD-155 763.
Order from OTS $0.50 PB 151 468

A method is presented for the preparation of fine particle ferromagnetic materials including metals, alloys, metals in metal oxides, mixed metal oxides, and ferrites. This method of preparation is based on the thermal decomposition of the bimetal oxalates and subsequent reduction or oxidation of the thermal decomposition products.

Electronics

Air Force Cambridge Research Center, Bedford, Mass.
SURFACE CLEANING BY GLOW DISCHARGE, by William T. Spencer. Aug 57, 22p. AFCRC TR-57-119; AD-133 770.
Order from LC mi $2.70, ph $4.80 PB 136 082

A discussion of the electrical discharge through a low-pressure gas is presented, with particular attention given to the glow discharge as applied to surface cleaning. The report includes three cleaning techniques, one of which, cathodic etching, has been studied in this laboratory. It has been found that evaporated metal films on germanium and silicon show improved wetting characteristics if the substrate is first cathodically etched. Consideration is directed to the work of other laboratories on related cleaning problems.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
BROAD-BAND BALANCED DUPLEXERS, by C.W. Jones. Rept. on Contract AF 19(122)458. 5 Apr 56, 18p. 13 refs. Technical rept. no. 113.
Order from LC mi $2.40, ph $3.30 PB 130 888

Balanced duplexer circuits are described and a comparison is made between the two principal configurations employing gaseous switching devices. The balanced TR duplexer is limited in power-handling ability, while the balanced ATR duplexer has slightly greater received-signal insertion loss. An analysis is made of the reflecting properties of an ATR array, and the practical upper limit of the number of array elements is determined.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
MARKOV-PROCESS REPRESENTATION OF RADAR DETECTION-TRIAL BINARY-DATA SEQUENCES, by G.C. Sponsler. Rept. on Contract AF 19(122) 458. 16 Apr 56, 56p. 30 refs. Technical rept. no. 114; AFCRC TN-56-311; AD-98 847..
Order from LC mi $3.60, ph $9.30 PB 130 887

Study of radar detection-trial data sequences has indicated the possible existence of interscan correlation in the statistical representation of such data. The probability theory of Markov processes is here applied to characterize the statistics of sequences of correlated binary data consisting of detections and nondetections upon individual radar scans. Simple and higher-order Markov processes are discussed with particular emphasis upon the theory of stationary discrete-parameter and non-stationary continuous-parameter, first-order processes. Likelihood ratio tests and maximum-likelihood parameter estimators are presented for the stationary discrete-parameter representations. An application of the continuous-parameter, first-order Markov process is made to the cumulative detection probability of an automatic-initiation equipped radar. Autocorrelation functions, first-order distribution of detections and the relation to information theory are briefly treated in appendices.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
MAXIMUM EFFICIENCY TRANSISTOR SWITCHING CIRCUITS, by R.H. Baker. Rept. on Contract AF 19(122)458. 22 Mar 56, 33p. 8 refs. Technical rept. no. 110.
Order from LC mi $3.00, ph $6.30 PB 130 890

The important transistor properties relating to switching-circuit design are discussed. Circuit configurations are presented which utilize the advantage of circuit symmetry possible through the combined use of p-n-p and n-p-n- transistors.

Molecular Physics and Spectroscopy

Florida State U., Tallahassee, Fla.
STRUCTURE AND BOND TYPE MOLECULAR COMPLEXES, by Raymond K. Sheline, Richard W. Wolfgang, and Rowland E. Johnson. Final technical rept. for 1 Feb 55-30 June 57 on Contract DA 01-009-ORD-461. July 57, 12p. 23 refs. AD-137 398.
Order from OTS $0.50 PB 131 949

This project was undertaken to analyze the structure and bond types in molecular complexes by spectroscopic methods and by isotopic exchange reactions. The following results were obtained: 1. The infrared spectra of cobalt tricarbonyl, $Co_4(CO)_{12}$ was determined. 2. The infrared spectra of two nickel cyanides, $K_4Ni_2(CN)_6$ and $K_4Ni(CN)_4$, were determined and their structure predicted. 3. A normal coordinate analysis of the $Fe(CO)_5$ molecule was made and a tetragonal pyramid structure assigned. 4. Thermochemistry of some metal carbonyls was investigated. 5. The isotopic rates of exchange of carbon monoxide with $Fe(CO)_5$, $Co_2(CO)_8$, $Co_2(CO)_6 \cdot C_6H_5C{\equiv}C_6H_5$, $Ni(CO)_4$, and $Mn_2(CO)_{10}$ were measured.

Texas U., Austin.
SPECTROSCOPIC COMPARISON OF π-σ TO π-π ELECTRON FORCES BETWEEN BENZENE AND VARIOUS DILUENT MOLECULES, by W.W. Robertson, J.M. Robinson, and S.E. Babb, Jr. Rept. on Contract AF 49(638)35. [1958] 6p. 7 refs. [AFOSR] TN-58-347; AD-154 252.
Order from LC mi $1.80, ph $1.80 PB 135 267

Optics

Ohio State U. Research Foundation, Columbus.
CONTINUATION OF INVESTIGATIONS OF TRANSMITTING AND ABSORBING MATERIALS FOR THE INFRARED REGION, by Wallace R. Brode. Rept. for 1 Oct-31 Dec 46 on Contract W44-009-eng-382. Jan 47, 17p.
Order from LC mi $2.40, ph $3.30 PB 135 441

This report has been divided into two sections. The first section comprises a report of new research performed since October 1, 1946. The second contains comprehensive and detailed instructions for the manufacture and testing of the infrared filters developed at The Ohio State University, and is enclosed in a separate cover. The main objective of this new research has been the investigation of various coloring materials showing selective absorption in the infrared with specific reference to the region between 0.7 and 15 microns.

Willow Run Lab., U. of Michigan, Ypsilanti.
EMISSIVITY OF A CONICAL BLACK BODY, by David F. Edwards. Rept. on Project Michigan, Contract DA 36-039-sc-52654. Nov 56, 16p. Rept. no. 2144-105-T.
Order from LC mi $2.40, ph $3.30 PB 135 455

The calculations of De Vos are extended to include the conical black body. The emissivity of a 15 degree conical black body is numerically evaluated and is compared with the emissivity values for the cylindrical and spherical black bodies. From these calculations it is concluded that the conical black body, with the appropriate baffle system and aperture, has an emissivity greater than the black body of a cylindrical or spherical shape. Also the

emissivity of the conical black body is relatively independent of the smoothness of the inner walls.

Solid State Physics

American Spectrographic Labs., Inc., San Francisco, Calif.
RESEARCH INVESTIGATIONS LEADING TO IMPROVEMENTS IN THE SPECTROCHEMICAL ANALYSES OF SEMICONDUCTING MATERIALS, by Charles E. Harvey. Quarterly rept. no. 1, 1 May-31 Aug 56 on Contract DA 36-039-sc-72313; Continuation of Contract DA 36-039-sc-63083.31. May 57, 10p.
Order from LC mi $1.80, ph $1.80 PB 137 189

In the analysis of metallic silicon at normal and reduced pressures, pure argon was found better than argon-oxygen mixtures for maximum sensitivity of detection of trace elements.

American Spectrographic Labs., Inc., San Francisco, Calif.
RESEARCH INVESTIGATIONS LEADING TO IMPROVEMENTS IN THE SPECTROCHEMICAL ANALYSES OF SEMICONDUCTING MATERIALS, by Charles E. Harvey. Quarterly rept. no. 2, 1 May-31 Aug 57 on Contract DA 36-039-sc-72313. 11p.
Order from LC mi $2.40, ph $3.30 PB 137 190

Procedures for detection of C, S, Se, Cl, Br, I, and F using briquets, with high voltage discharges in reduced pressure chamber. Detectability range .02-.2% except F.

American Spectrographic Labs., Inc., San Francisco, Calif.
RESEARCH INVESTIGATIONS LEADING TO IMPROVEMENTS IN THE SPECTROCHEMICAL ANALYSES OF SEMICONDUCTING MATERIALS, by Charles E. Harvey. Quarterly rept. no. 3, 1 Sep-31 Nov 57 on Contract DA 36-039-sc-72313. 12p.
Order from LC mi $2.40, ph $3.30 PB 137 191

Further investigations of procedures for detection of C, S, Cl, Br, I, Se using briquets with high voltage discharges in reduced pressure. Detection of small weight carbon, .01 mg also established. Improved detectability for non-metallic elements noted.

American Spectrographic Labs., Inc., San Francisco, Calif.
RESEARCH INVESTIGATIONS LEADING TO IMPROVEMENTS IN THE SPECTROCHEMICAL ANALYSES OF SEMICONDUCTING MATERIALS, by Charles E. Harvey. Final rept. for 1 Dec 57-31 Jan 58 on Contract DA 36-039-sc-72313; Continuation of Contract DA 36-039-sc-63083. 13p.
Order from LC mi $2.40, ph $3.30 PB 137 192

The study of techniques for the spectrographic determination of seven non-metallic elements was continued. In addition, an extensive study was made to determine the feasibility of detecting nitrogen, oxygen and hydrogen, either simultaneously or by a parallel technique. A new wavelength setting was used on the spectrograph, covering the region from 2480 to 4820 angstroms. This made available a better choice of lines for most elements and more sensitive lines in some instances. In addition, a new series of standards was prepared to set up working curves for various elements. Several additional variables were also investigated. The detection and measurementsof the permanent gases centered on emission band spectra, rather than line spectra as in the case of the other elements. While these results were not entirely conclusive, the principal difficulty lay in eliminating a high "blank" rather than in detection of the elements. Of the three, the detection of nitrogen was the most satisfactory.

Armour Research Foundation, Chicago, Ill.
PROPERTIES OF SULFIDE SEMICONDUCTORS, by J.W. Buttrey. Technical rept. no. 1, 1 Jan-31 Dec 57, on Contract AF 18(600)1168. 1 July 58, 9p. AFOSR TN-58-596; AD-162 120.
Order from LC mi $1.80, ph $1.80 PB 136 159

The fabrication methods and electrical characteristics are being investigated of a group of sulfides, selenides, and tellurides. Unsuccessful attempts were made to fabricate semiconductors from either MoS_2 or NiS because of cracking or high reactivity. Samples of Sb_2Se_3, ZnTe, PbTe samples were prepared by melting the constituents in a fused quartz tube in a hydrogen atmosphere. The Sb_2Se_3 samples showed semiconducting properties with an activation energy of 0.82 ev. A Zn Te sample had metal-like conductivity as a function of temperature. Hall measurements indicated that the number of carriers was in excess of 5×10^{20}/cc.

Colorado A. and M. Coll., Fort Collins.
RESEARCH INVESTIGATIONS ON FUNDAMENTAL AND OVERTONE CRYSTALS, by Virgil E. Bottom, John G. Deininger and others. Final rept. 15 Apr-30 June 53, on Contract DA 36-039-sc-66. 42p. 12 refs. AD-18 541.
Order from LC mi $3.30, ph $7.80 PB 136 220

Lattice parameter measurements have been completed on two samples of synthetic quartz. The electrical conductivity of a number of samples of natural and synthetic quartz has been measured and the effects of irradiation and heat treatment are described. Passage of an electric current through a specimen of quartz removes its susceptibility to blackening by x-rays. Completed measurements of the values of the equivalent circuit parameters for thirty high frequency crystal units are reported.

Freudenthal, Alfred M., New York.
STRESS RELAXATION IN STRUCTURAL MATERIALS, by Alfred M. Freudenthal. Rept. for May 57-

May 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)2729. Oct 58, 45p. 27 refs. WADC Technical rept. 58-168; AD-202 497.
Order from OTS $1.25 PB 151 516

The phenomenon of stress-relaxation is discussed in relation to its physical origin, its mathematical representation, its experimental determination and its design significance, with particular emphasis on the interrelation between creep and relaxation in metals and in polymers. While the relaxation behavior of materials is of primary importance in design, particularly with regard to flight structures operating under conditions of varying temperatures it appears that neither the present methods of direct "relaxation testing" nor the conversion of creep-data into relaxation-data provide useful and reliable information concerning the relaxation behavior of the material.

Gordon McKay Lab. of Applied Physics, Harvard U., Cambridge, Mass.
PREPARATION OF POLYCRYSTALLINE FERRITES FOR MICROWAVE APPLICATIONS, by J.E. Pippin and C.L. Logan. Scientific rept. no. 8 on Contract AF 19(604)1084. Jan 58, 59p. 21 refs. AFCRC TN-[57]-571; AD-117 295.
Order from OTS $1.50 PB 151 020

The procedure for preparing low-loss high-density nickel ferrite is presented without effect of modifications. Chemical modifications of ferrite compositions include nickel-manganese, nickel-copper, nickel-zinc and nickel-cobalt ferrites; nickel ferrite-aluminates; nickel-cobalt ferrite-aluminates; and other combinations. Density and loss tangent as functions of firing temperatures are shown for a magnesium-manganese ferrite with an excess of magnesium oxide.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
CLASSICAL BOLTZMANN THEORY OF CYCLOTRON RESONANCE, by Herbert J. Zeiger, Benjamin Lax, and Richard N. Dexter. Rept. on Contract AF 19(122)458. 4 Oct 56, 30p. 43 refs. Technical rept. no. 136.
Order from LC mi $2.70, ph $4.80 PB 130 879

A classical Boltzmann model of cyclotron resonance with an energy-independent collision time is examined in detail for ellipsoidal constant-energy surfaces, and for slightly warped-spherical constant-energy surfaces. The results are used to obtain line-shape expressions for transverse and longitudinal cyclotron resonance for 8-ellipsoid and 6-ellipsoid models. An approximate solution of the Boltzmann equation is obtained for cyclotron resonance on warped-spherical energy surfaces. The solution yields a fundamental cyclotron-resonance absorption line, which shows line-shape anisotropy, as well as a shift in resonance peak with magnetic-field direction. The theory also indicates resonant absorption at harmonics of the fundamental cyclotron resonant frequency, due to the warping of the constant-energy surfaces.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
GALVANOMAGNETIC EFFECTS IN N-TYPE GERMANIUM, by W. Murray Bullis. Doctoral thesis. Rept. on Contract AF 19(122)458. 14 May 56, 158p. 96 refs. Technical rept. no. 115.
Order from LC mi $7.50, ph $24.30 PB 130886

The galvanomagnetic effects in n-type germanium have been investigated theoretically and experimentally at 77°K and 300°K. The solution of the Boltzmann transport equation for spheroidal energy surfaces is given under the restrictions of steady state and isothermal conditions, uniform material, classical statistics and a first order expansion of the distribution function. Collisions which either conserve energy or randomize the final velocity, and thus may be represented by a relaxation time which is a second rank tensor, are considered. The conductivity and resistivity tensors are calculated for the 8-ellipsoid model for the conduction band of germanium, first for an arbitrary energy dependence of the collision time and with no restrictions on the orientation of the applied fields. These tensors are then specialized to particular orientations of the magnetic field (the [001], [110], and [111] directions and the [001] and [110] planes) for which explicit formulas are given. The various galvanomagnetic coefficients - the magnetoresistance , Hall and planar Hall - are defined in terms of the tensors, and relations are given which hold at low fields or at high fields for arbitrary energy dependence of the scattering time.

Technical Operations, Inc., Burlington, Mass.
QUALITATIVE CONVERSION BY PHOSPHORS OF THE ENERGY OF BETA PARTICLES INTO FLUORESCENT QUANTA, by Allan Shepp. Final rept. on Contract AF 18(600)1134. Apr 58, 73p. 9 refs. Rept. no. TOI 58-12; AFOSR TR-58-56; AD-154 270.
Order from OTS $2.00 PB 131 997

This final report is divided into three sections. Section I is an extensively detailed report on method and results for the absolute fluorescence energy efficiency and the practical fluorescence energy of a crystal of anthracene, at room temperature, under excitation of Sr^{90} β-ray. Section II is a moderately detailed report on work on the vapor phase fluorescence of anthracene and naphthalene under tritium (T^3) β-ray excitation. Section III briefly reviews work on inorganic phosphers, purification techniques, and plastic scintillators. (See also PB 125 644)

Thermodynamics

Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
EFFECT OF TRANSVERSE VIBRATIONS ON THE HEAT-TRANSFER RATE FROM A HEATED VERTICAL PLATE IN FREE CONVECTION, by A.J. Shine. Dec 57, 174p. 11 refs. Technical rept. 57-13.
Order from LC mi $8.40, ph $28.80 PB 135 423

An analytical study is presented in which the model for the change in the heat-transfer rate depends on an orderly variation of the boundary thickness as the plate oscillates.

Army Chemical Warfare Labs., Army Chemical Center, Md.
THERMOMETRIC METHOD FOR THERMODYNAMIC STUDIES AND MOLECULAR WEIGHT DETERMINATIONS IN SOLUTIONS, by W.I. Higuchi, E. G. Rippie, and T. Higuchi (U. of Wisconsin). Mar 58, 22p. 10 refs. CWL Special pub. 2-6.
Order from OTS $0.75 PB 151 035

A useful apparatus for determination of solvent activities of aqueous and nonaqueous solutions is described. The method consists essentially of determining the temperature difference of a solution and its solvent when brought into quasi vapor equilibrium in an evacuated enclosure. The theory and the basic limitations of the procedure have been explored.

Convair, Fort Worth, Tex.
HEAT TRANSFER TO BOILING WATER, by R.L. Pons. 24 June 54, 62p. 11 refs. Rept. no. FZA-4-135; AD-44 319.
Order from LC mi $3.90, ph $10.80 PB 136 150

The results are presented of analytical and experimental studies for use in a program to produce a boiling water heat exchanger for the MX-1964 cooling system. A theoretical analysis of the boiling process, based on methods suggested in the literature, has been developed to predict the influence of saturation temperature and air side mass flow on heat exchanger effectiveness. Comparison of theory with Convair experiment for two types of heat transfer surface is shown. Comparison of predicted and measured pressure drop is shown.

Cornell U., Ithaca, N.Y.
ULTRA-HIGH VACUUM MASS SPECTROMETER FOR THE STUDY OF THE SURFACES OF SOLIDS, by Richard C. Bradley. Technical rept. no. 6 on Theoretical and Experimental Investigations of the Atomic Phenomena Occurring on and Near the Surfaces of Solids, Contract AF 18(600)674. Mar 58, 75p. 25 refs. AFOSR TN-58-97; AD-148 146.
Order from OTS $2.00 PB 151 040

Surface atoms are removed either by ion bombardment or by evaporation and are mass analyzed in a 60^{o} sector field mass spectrometer with a six-inch radius of curvature. The results of certain experiments on the surfaces of three refractory metals (molybdenum, tantalum, and platinum) are presented.

Engineering Research Inst., U. of Michigan, Ann Arbor.
HEAT-TRANSFER CHARACTERISTICS OF BOILING OXYGEN, FLUORINE, AND HYDRAZINE. PART A: OXYGEN BOILING ON OUTSIDE OF SINGLE TUBES AND WIRES, by J.T. Banchero, G.E. Barker and R.H. Boll. Final rept. Pt. A, on Contract AF 33 (038)6677. Nov 51, 282p. 16 refs. ATI-155 019.
Order from LC mi $11.10, ph $34.10 PB 136 151

Illinois Inst. of Tech., Chicago.
HEAT AND MASS TRANSFER. BIBLIOGRAPHY WITH SELECTED ABSTRACTS, by W.J. Christian and T.H. Schiffman. Rept. on Study of Mass Transfer of Water with Air Flow at Mach 0.5 to 0.9, Contract AF 18(600)153. May 58, 172p. 286 refs. WADC Technical rept. 58-186; AD-151 199.
Order from OTS $3.00 PB 151 517

This report presents a literature survey concerning (1) local and average mass transfer from surfaces under isothermal and non-isothermal conditions; (2) local and average heat transfer from pertinent airfoil surfaces and (3) correlations between heat and mass transfer.

Institute of Engineering Research. U. of California, Berkeley.
THERMAL RADIATION PROJECT, by R.V. Dunkle, N.W. Snyder and others. Final rept. 1 May 47-1 Sep 50 on Contract N7onr-295(01). 129p. 2 refs. ATI-154 729.
Order from LC mi $6.30, ph $19.80 PB 137 126

The primary objectives are (1) The development of radiation standards for radiometeric calibrations (2) The investigation of spectral characteristics of transmitters, reflectors and absorbers of radiant energy, such as, painted surfaces and metals (3) The measurement of radiation energy properties of materials and surfaces.

Little, Arthur D., Inc., Cambridge, Mass.
THERMAL RADIATION CHARACTERISTICS OF SOLID MATERIALS: A REVIEW, by Henry H. Blau, Jr., John L. Miles, and Leland E. Ashman. Scientific rept. no. 1 on Contract AF 19(604)2639. Mar 58, 91p. 244 refs. AFCRC TN-58-132; AD-146 833.
Order from OTS $2.25 PB 131 962

This report is a critical evaluation of the basic literature (1900 through 1957) dealing with the thermal radiation characteristics of solid materials.

Massachusetts Inst. of Tech., Cambridge.
TOTAL NORMAL EMISSIVITIES AND SOLAR ABSORPTIVITIES OF MATERIALS, by G.B. Wilkes. Rept. for May 48-to June 50 and Sep 50-Apr 51 on Contract W33-038-ac-20486. Mar 54, 104p. 75 refs. WADC Technical rept. 54-42; AD-88 066.
Order from LC mi $5.70, ph $16.80 PB 136 300

The objective of this program was to determine the total normal emissivities and solar absorptivities of materials, with and without specified coatings and surface treatments that may be used on the

exterior surfaces of proposed aircraft and missiles. The metals tested and reported include stainless steels, mild steels, Monels and Inconels, aluminum alloys, and Dow metal.

Wave Propagation

Air Force Cambridge Research Center, Bedford, Mass.
DEPENDENCE OF VHF/UHF EXTRA-DIFFRACTION TROPOSPHERIC FIELD STRENGTHS ON DISTANCE, ANTENNA HEIGHT, AND HORIZON ANGLES, by Edward J. Martin. May 58, 26p. 22 refs. AFCRC TR-58-149; AD-152 415.
Order from LC mi $2.70, ph $4.80 PB 136 047

A simple working model of tropospheric propagation beyond the diffraction region provides the basis for interpreting experimental measurements and estimating path losses in terms of the single parameter "effective distance." Experiments show that field strengths are accurately predicted for antennas at great heights. A quantitative prediction of path losses over a smooth earth was derived empirically from available field strength data. The prediction was extended to include the estimated effect of positive horizon angles. Communications engineers should find this a useful tool in designing circuits of 100 to 600 "effective" miles at frequencies of 100 to 1000 mc.

Airborne Instruments Lab., Inc., Mineola, N.Y.
PROPAGATION OF ELECTROMAGNETIC WAVES, by R.G. Malech and S.J. Blank. Final rept. for June 57-May 58 on Contract AF 19(604)2446. June 58, 101p. 4 refs. Rept. no. 4571-1; AFCRC TR-58-125. AD-152 360.
Order from LC mi $5.70, ph $16.80 PB 135 938

Effort was made to (1) measure the near and far fields of modulated surface-wave structures; (2) calculate the far-field radiation patterns from the near-field amplitude and phase functions, and compare the measured and calculated results; and (3) determine the bandwidths of the surface-wave structures. Near- and far-field measurements were made of electromagnetic waves propagating along and emanating from structures whose equivalent index of refraction is a function of the direction of propagation. A small dipole probe was used to sample the near field. A dipole and a circular ground plane were used to energize the arrays of parasitic dipole elements, and a measurement was made that yielded an approximation of the excitation efficiency. The near fields were measured along the three orthogonal axes for the linearly tapered ladder antenna, and along the axis of propagation as a function of frequency for other antennas. Far-field radiation patterns of the 2 principal planes and of a modulated structure were measured at frequencies corresponding to the measurements of the near field. The linearly tapered array is considered in detail at 2500, 2750, and 3000 mc. Approximations were made of the relative near-field amplitude and phase velocity as a function of distance along the array. At 2750 and 3000 mc, the calculated patterns, using an unmodulated wave, show agreement with the measured patterns. There is a discrepancy between the measured and calculated far fields at 2500 mc.

Defense Research Lab., U. of Texas, Austin.
MEASUREMENTS OF SHORT BENDING WAVE PULSES IN STEEL BARS, by E.A. Ripperger. Rept. on Contract NOrd-9195. 20 July 55, 24p. DRL-367; CM-838.
Order from LC mi $2.70, ph $4.80 PB 135 332

Measurements showing propagational characteristics of bending wave pulses having initial durations ranging from about 3.5 microseconds to about 30 microseconds were made on a cylindrical bar 1/2" in diameter, on cylindrical bars of other diameters and on bars with rectangular cross sections.

Geophysical Inst., U. of Alaska, College.
ARCTIC RADIO WAVE PROPAGATION, by Leif Owren and C. Gordon Little. Final rept. on Analysis of C-W Data, Contract DA 36-039-sc-71137. Mar 58, 105p. 11 refs.
Order from LC mi $5.70, ph $16.80 PB 136 215

The relation between polar black-outs and signal outages on the short HF transmission paths of "Experiment Aurora" have been analyzed for a year of high solar activity (1949-50) and compared with the results of a similar analysis for a year of low solar activity (1954).

Georgia Inst. of Tech., Engineering Experiment Station, Atlanta.
EFFECT OF RADIANT DISTRIBUTIONS ON METEOR-SCATTER COMMUNICATION, by M.L. Meeks and J.C. James. Technical rept. no. 2 on Contract Nonr-991(02). 37p. 14 refs. AD-150 236.
Order from LC mi $3.00, ph $6.30 PB 135 275

The theoretical analysis of uniform and ecliptic radiant distributions by J.C. James and M.L. Meeks (AD-105 767) has been extended to include an examination of some geometrical aspects of the forward-scatter problem and the study of point radiants which are of fundamental importance in the study of meteor showers. In addition, experimental studies of sporadic and shower components have been performed to test the theoretical predictions. These experiments have been done on the comparatively short Knoxville-Atlanta link (250 km) with identical seven-element Yagi antennas. The motivation for these studies is to gain an insight into the relative contributions of various sky regions to meteor-scatter communication. Once an adequate insight is obtained into this problem, there will be a rational basis for the design and evaluation of antenna systems for meteor-scatter communications. On the basis of our experimental and theoretical studies thus far, the diffuse ecliptic distribution of radiants, which has been observed by Hawkins and others

(Harvard Univ., Radio Meteor Research Program Progress rept. no. 19, March, 1957) appears to be valid. Further studies, now underway, to apply the point radiant computation to the sporadic radiant distribution appear promising.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
ON METEOR ECHOES FROM UNDER-DENSE TRAILS AT VERY HIGH FREQUENCIES, by Morton Loewenthal. Rept. on Contract AF 19(122)458. 13 Dec 56, 69p. 18 refs. Technical rept. no. 132.
Order from LC mi $3.90, ph $10.80 PB 130 882

The cylindrical model for a weakly ionized meteor trail leads to a $(\text{wavelength})^3$ dependence in the reflected power and a $(\text{wavelength})^2$ in the duration of the echo. In the frequency ranges that have been investigated most extensively (25 to 100 Mcps), both these laws agree with the experimental evidence. It is apparent, however, that such agreement cannot continue with increasing frequency, since the derivations of the frequency dependence ignore the trail-formation process; that is, they assume that the time for the meteor to produce the reflecting trail is small compared to the duration of the echo. It is the purpose of this report to analyze the behavior of the echo in the frequency range where the time of trail formation is important. As a result, it is found that the duration and amplitude of the echoes are considerably smaller than those predicted by the lower frequency relations. The theory involves the properties of Fresnel integrals or error functions of complex arguments.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE SUGGESTED ROLE OF STRATIFIED ELEVATED LAYERS IN TRANSHORIZON SHORT-WAVE RADIO PROPAGATION, by J. R. Bauer. Rept. on Contract AF 19(122)458. 24 Sep 56, 47p. 51 refs. Technical rept. no. 124.
Order from LC mi $3.30, ph $7.80 PB 129 625

Evidence is presented for the existence of very thin substrata within the gross structures of extensive horizontally stratified, elevated, inhomogeneous, dielectric layers between the heights of 1 and 3 km above sea level.

Maryland U., College Park.
NOTE ON THE FORMULATION OF THE CAUSALITY REQUIREMENT, by John G. Taylor and John S. Toll. Technical rept. no. 110 on Contract AF 49(638)24. [1958] 13p. 5 refs. AFOSR TN-58-631; AD-162 161.
Order from LC mi $2.40, ph $3.30 PB 136 155

Segal's recent formulation of the causality requirement is considered. This formulation is shown to differ in important respects from the usual requirement of "no output before input" and certain difficulties of physical interpretation are discussed.

Raytheon Mfg. Co., Waltham, Mass.
IONOSPHERE PROPAGATION STUDIES, by Leonard C. Edwards. Scientific rept. 2-3, 15 Dec 57-15 Mar 58, on Contract AF 19(604)2246. 15 Apr 58, 48p. AFCRC TN-58-144; AD-152 373.
Order from LC mi $3.30, ph $7.80 PB 136 051

The second year of data collection was begun over the Greencastle, Indiana to South Dartmouth, Massachusetts scatter link. Average values of scatter signal level were several db lower during November 1957 to February 1958 period than during the same period a year earlier. As was observed in 1957 the approach of the vernal equinox was accompanied by an appreciable decrease in the scatter signal level. The diurnal variation in scatter signal level recorded over the North-South Greencastle to GBI path was very similar to that recorded over the East-West path. Although the signal dropped into the noise during the night the level received during the day was about 10 db higher than expected on the basis of a comparison of GBI system gain with that for the South Dartmouth system. This again emphasizes the necessity for clarifying the situation regarding realized antenna gain. Data obtained using the interferometer or split beam antenna system was inconclusive. The scattering area contributing to the signal level apparently is large compared to the area illuminated by a single lobe of the system. Modifications to the antenna lobe structure must be made. A search of signal level-recordings made at South Dartmouth revealed no evidence of signal enhancements which might be attributed to reflection from ionization associated with the passing of a satellite.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Engineering Research Inst., U. of Michigan, Ann Arbor.
CONSTRUCTION OF A SECTOR SHOCK TUBE, by O. Laporte and A. L. Cole. Progress rept. no. 7 on Contract Nonr-1224(18). June 57, 13p. 2539-7-P; AFSWP-1039.
Order from LC mi $2.40, ph $3.30 PB 135 523

This report presents (1) the desirability of the construction of a tube in which shocks can be studied; (2) a chronological account of the construction of the tube, including a description of materials used and methods employed; and (3) plans for future investigation.

Information Theory

Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio.
MINICARD INDEXING STUDY, by Allen Kent, J. W. Perry, and M. E. Egan. Rept. no. 2, 15 Mar-14 Apr 56 on Contract AF 30(602) 1498. 23 Apr 56,

71p. RADC TN-56-226; AD-101 704.
Order from LC mi $4.50, ph $12.30 PB 136 235

Although there are variations in the kind of knowledge needed for successful accomplishment of various kinds of professional activity and also differences in the way that new knowledge of interest to different professions is generated, the same basic principles and also similar methods and techniques may be adapted for making recorded knowledge available to meet varying requirements.

Institute of Statistics, North Carolina U., Chapel Hill.
ON THE CONSTRUCTION OF A CLASS OF ERROR-CORRECTING BINARY SIGNALLING CODES, by R.C. Bose and Roy Kuebler, Jr. Rept. on Contract AF 18(600)83. May 58, 181p. 8 refs. Mimeograph series no. 199; AFOSR TN-58-551; AD-158 368.
Order from LC mi $8.40, ph $28.80 PB 136 070

The theory of communications and the more general information theory are concerned with the transmission of pieces of information from one point to another. In all practical situations, the means of transmission -- the channel -- is subject to chance disturbances which have the effect that there is a positive probability that the reporting mechanism at the output end of the channel will make an announcement different from the piece of information which was introduced into the input end of the channel. A central problem is to devise encoding-decoding schemes which will keep small the probability of such erroneous report while utilizing as nearly as possible the full capacity of the channel.

Photographic Equipment

Diamond Ordnance Fuze Labs., Washington, D.C.
USE OF PHOTOLITHOGRAPHIC TECHNIQUES IN TRANSISTOR FABRICATION, by J.R. Nall and J.W. Lathrop. June 58, 14p. TR-608.
Order from OTS $0.50 PB 151 118

Techniques are described for the use of photosensitive coatings in the fabrication of semiconductor devices. The chemical, optical, and thermal characteristics of the coatings are outlined and techniques of exposing and developing patterns are given. Application of photolithographic techniques to the specific problems of vacuum deposition, electrodeposition, and etching is discussed.

Engineering Research Inst., U. of Michigan, Ann Arbor.
PRECISION PHOTOENGRAVING OF MACHINE PARTS, by A.L. Rock. Technical memo. no. 31 on Contract DA 36-039-sc-63203. Aug 56, 19p. 2262-126-T; AD-115 400.
Order from LC mi $2.40, ph $3.30 PB 135 439

The photoengraving method described in this report was used in manufacturing a set of trajectory cams which had maximum dimensions of approximately five inches by one half inch. The cams were machined from 1/16 inch carbon steel gage stock to an accuracy of approximately two mils. The photography, photoengraving and machining were done in our own laboratories to obtain the highest possible accuracy, and in the interest of time saving and economy. The procedures followed are described in detail.

Perkin-Elmer Corp., Norwalk, Conn.
FIRST FIELD TEST RESULTS OF THE RECORDING OPTICAL TRACKING INSTRUMENT (ROTI MK. II), by G. Economou, W. McCammond, and T.P. Fahy. Rept. on Contract AF 08(606)1047. 5 July 57, 17 p. Engineering rept. 5123; AFMTC TN 57-25; AD-124 150.
Order from LC mi $2.40, ph $3.30 PB 136 078

The installation and field operation of the ROTI MK II is described briefly. Experience with 24-inch aperture, long focal length telephoto systems for daylight cine photography has been so limited that there was some concern over the results to be expected with the ROTI Mark II. This report illustrates the level of photography that can be attained. Photographs of targets at 30 miles distance were taken at low elevation angles. Details of one-third second of arc were resolved.

SOCIAL SCIENCES

Yoh, H.L., Co., Philadelphia, Pa.
ANNOTATED BIBLIOGRAPHY OF APPLIED PHYSICAL ANTHROPOLOGY IN HUMAN ENGINEERING, by Robert Hansen and Douglas Y. Cornog. Rept. on Contract AF 33(616)2353. May 58, 311p. 149 refs. WADC Technical rept. 56-30; AD-155 622.
Order from OTS $5.00 PB 151 447

This volume contains condensations of 121 reports in the field of Applied Physical Anthropology. A majority of the annotations are grouped under three headings, Anthropometry, Biomechanics, and Comfort; a few are included in a General Group. Working data and important illustrations are quoted directly from the original papers in most cases. A complete index is arranged by author as well as by subject. An additional list of reports (not annotated) is included as background material. Two appendixes containing relevant commentary on Seating Comfort and Anthropomorphic Dummies are also included.

Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS. Mar 59.
Order from OTS $1.25, $10.00/year PB 151 336

Contents:
Articles:
Photography from the Viking 12 rocket at altitudes ranging up to 143.5 miles, by R.C. Baumann and L. Winkler
Methods for the study of growth imperfections in crystals, by P.L. Smith, J.W. Davisson, and W.H. Vaughan
Scientific Program:
Applications Research: Digitalized pickoff display converter for data-handling systems. Man-machine factors in the NRL nuclear research reactor control system
Astronomy and Astrophysics: Computation of singly scattered radiation from a distant source when the angular scattering function is known
Chemistry: Effect of hydrogen pressure on the hydrogen overvoltage on bright platinum. Instrument with multicoil movement indicates algebraic sum of five dc signals which may represent gas concentrations or some other variable
Mechanics: Nondestructive method for determing the areas of high stress in aircraft glazing material. Analysis of methods by which electrodynamic shakers are compensated to provide random-motion tests
Metallurgy and Ceramics: Crack propagation tests with stress-corrosion cracked specimens of Type 422 stainless steel. Charpy-V transition temperatures of iron-oxygen and iron-aluminum alloys. Determination of cadmium in silver bromide. Foundry characteristics of Mn-V-Mo age-hardening austenitic steel. Factors affecting the performance of mold and core sand bonded with sodium silicates.
Nuclear and Atomic Physics: Measurement of the half-life of B^8. Resonances in the yield of γ-rays as a function of proton bombarding energy
Optics: Examination of the discharge path in a flash tube containing a β-ray-gun electrode
Radio: Attenuation of electromagnetic radiation by sea water. An eight spiral doublet electromechanical scanning array
Solid-State Physics: Production of color centers in alkali halides at low temperatures. Efficiency of the thermomagnetic generator
Sound: New cypress tank to aid acoustical experimentation in a controlled underwater environment
Supporting Techniques: Soldered beryllium windows

ATOMIC ENERGY COMMISSION REPORTS

Reports may be purchased in accordance with instructions on the inside front cover of the U.S. GOVERNMENT RESEARCH REPORTS. As PB numbers are not indicated, order by series and number. These reports may also be consulted at any AEC Depository Library. A list of these libraries may be obtained from the U.S. Department of Commerce, Office of Technical Services, Washington 25, D. C.

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